

# ANNALS OF SURGERY

MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY  
LEWIS STEPHEN PILCHER, M.D., LL.D.,  
OF NEW YORK

WITH THE COLLABORATION OF

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## ORIGINAL MEMOIRS.

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### GASTROCOLOPTOSIS \*

ITS PATHOLOGICAL SIGNIFICATION AND ITS SURGICAL TREATMENT

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#### I PATHOLOGICAL SIGNIFICATION

For the subject of this paper I have chosen a question upon which American and Danish surgeons have for many years worked with the same object in view, and, in principal, with the same methods. While the majority of the surgeons of Europe and almost the entire medical world have no comprehension of the enormous pathological significance of gastrocoloptosis nor, in consequence, of the therapeutic problems which here present themselves, gradually, every one has now begun to agree about one thing—that a large number of those individuals with whom one finds gastroptosis and coloptosis suffer to a great extent from a series of symptoms of which constipation is the first and most constant, while cardi-algia, vomitings, emaciation, and a host of nervous symptoms are added little by little, and complete the aspect of the disease of these wretched patients. But here unanimity ceases, because, while I and probably all, who are votaries of a surgical therapy with the severe cases of ptosis, regard the above-

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\* Read before the Surgical Section of the American Medical Association, June 5, 1912



mentioned morbid symptoms as a result of the ptosis, the others regard the ptosis as an irrelevant, co-ordinate symptom. This difference of opinion corresponds with and rests on the diversity which prevails in the conception of the pathogeny of enteroptosis. Essentially there are two theories which have governed the medical men's conception of ptosis as a secondary, rather insignificant phenomenon. The one, Glénard's theory, tends to show that enteroptosis is the result of an enigmatic nutritive disease, a "diathèse hépatique," which involves atrophy and prolapse of the small intestines, whereby the organs lying above lose their support, which secondarily leads to gastropptosis, hepatoptosis, etc. This theory has now been abandoned by most in favor of Stiller's hypothesis which, in place of Glénard's mysterious liver-disease, sets up a so-called congenital, universal asthenia, a congenital weakness, laxity, and gracility of the entire structure of the body, as of the individual tissues. The ptosis and the constipation should be due to laxity and atony of the tissues, the pains and the nervous symptoms to neurasthenia—the whole simply being a manifestation of degeneration, and, as degeneration cannot be cured, it is natural that all votaries of this doctrine must regard a surgical therapy for enteroptosis as senseless.

I think, however, that one is justified in expressing a certain wonder that Stiller's hypothesis is accepted unreservedly and without criticism by the majority of physicians the world over, because there is one fact, which, even where Stiller's theory is regarded quite superficially, seems to deliver a *coup-de-grâce*. It is the circumstance *that enteroptosis is so rare with men and so very frequent with women that it must almost be considered a feminine disease par excellence*. But even the most conceited and discourteous of men will not insist on this degeneration being reserved for women. Unfortunately we certainly have to admit that, in this respect, the two sexes have nothing to reproach each other with. Nor is there any lack of thin, badly built, neurasthenic men, but it is very seldom that these suffer from constipation and the dyspeptic symptoms which characterize the ptosis patients.

Simple logic tells us, therefore, that Stiller's theory is in the main at fault, and tells us to look around for another explanation of the overwhelming frequency of ptosis with women. In my opinion a very simple explanation is found in two circumstances peculiar to women (1) their misuse of corsets and lacings, and (2) the changes which pregnancy and childbirth involve in the intra-abdominal pressure. Here we have the two momenta which fully explain enteroptosis as a feminine disease par excellence: the one causes an active subsidence of the subdiaphragmatic organs and stretches and lengthens the suspensory ligaments, while the other removes that support which the intestines, when compressed by a vigorous abdominal wall, offer the subdiaphragmatic organs. The two Russian investigators, Wolkow and Delitzin, are surely right when in their excellent work on nephroptosis they compare the small intestines to an air-filled pelotte which, so long as it is supported by the elastic pressure of a vigorous muscular abdominal wall, bears up the subdiaphragmatic organs: the stomach, the liver, and the kidneys. When, after many childbirths, the abdominal wall becomes like a sort of slack bag into which the small intestines subside, then the organs mentioned not only lose their support but are dragged, sucked, and drawn downward. Their power of resistance against this then depends entirely on the firmness and solidity of the ligaments and peritoneal duplicatures by which they are attached to the diaphragm. If these are feeble, thin, and atrophied as with Stiller's degenerated type of mankind, or lengthened by the use of corsets and lacing, and the organs forced down, the ptosis proceeds rapidly,

Of Stiller's theory, then, there remains only this: that the corset and lace pressure, when brought to bear upon quite young, half-grown girls with soft, relaxable ribs, naturally has specially easy play with the degenerative type, the bones and tissues of whom are particularly relaxable and flaccid. Among ptosis patients we therefore find many of this female type represented, and this explains, to a certain extent, the origin of the theory, but is no excuse for the complete regard

which has been paid to it, because, for that ptosis is a too frequent phenomenon with originally quite normal women

The rare cases of ptosis with men almost all occur with men of Stiller's type, men with a feeble bone and muscle structure, and then generally with men who have used tightly buckled belts

But if we have thus had to abandon the theory of degenerative universal asthenia as the cause of the ptoses, then we must also abandon the idea of constipation, cardialgia, vomitings, emaciation, nervous symptoms, etc., being the outcome of "degenerative asthenia." It is most natural, therefore, to ascertain whether all these symptoms cannot be explained as pains released and caused by the ptosis itself

Even in that article in "Hospitalsidende," in which in 1898 I reported my first case of gastropexy, which led to a permanent cure of the considerable sufferings of this ptosis patient, I set forth in its main features the conception that all the morbid symptoms and conditions which we find typical in patients with enteroptosis allow themselves naturally and spontaneously to be explained as a result of the ptosis. The correctness of this conception has only been confirmed by the observation and study of the 400 cases which I have personally treated, the statistics of which are embodied in the present communication

In order to substantiate this, I shall give a short description of the aspect of the typical symptoms which I have found with gastropexy, and of their development

Confining the discussion, for the present, to gastrocoloptosis with women, I discriminate between two principal groups, which, both as regards the pathogeny and the symptomatology, are rather sharply distinguished from each other, they are *virginal* ptosis and *maternal* ptosis

## II VIRGINAL GASTROCOLOPTOSIS

*Symptomatology*—In the course of the first or second year after the commencement of puberty, and when the wearing of corsets commences, the previously healthy individual

begins to suffer from *persistent constipation*, whereto are quickly added weariness, headache, loathing of food. In addition to these symptoms there occurs after some time cardialgia, in the form of severe pains which are always situated to the left of the centre line and occur as soon as the patient partakes of food. The quality of the food has no significance so far as the rise of these pains is concerned, whereas the quantity—the mass and weight of the food—is of great importance, for which reason these patients can only get along by taking many quite small meals during the 24 hours. In many instances the commencement of the pains is accompanied by vomiting, and with a smallish group of these patients each meal was invariably and immediately succeeded by the discharge of a part or the whole of the food partaken of. In the first instance, the patients may maintain an astonishingly healthy appearance for many years, but if they disgorge everything, and are furthermore frightened by fear of the pains from attempting to eat, emaciation sets in, which may often reach an extreme stage and present that aspect which I have called gastropotosis-cachexia, and which may result in the death of the patient as a consequence of inanition.

By examining the chemical function of the stomach one generally finds that the measure of acidity is normal, but in a certain number of cases one finds achylia, and in others, conversely, hyperacidity and even gastrosuccorrhœa.

In more than half of the cases the motor function is completely normal, inasmuch as the stomach empties itself entirely in the course of 4–5 hours. In 30–40 per cent of the cases there is a slight delay (5–7 hours), while food remains are rarely found 8 hours after one of Bourget's experimental meals.

With many of these patients a whole series of nervous symptoms develop gradually as a result of this state of auto-intoxication and inanition, such as oppression across the loins, in the pelvis and the abdomen, clammy hands and feet, palpitation of the heart, physical depression, with some a mental relaxation and with others a sensation of dread.

Finally disturbances in the function of the genital organs develop very rapidly, because the menstruation becomes irregular and is accompanied by diffuse pains in the abdomen and a deterioration of the regular symptoms. The menstruation is frequently very deficient, and for years may entirely fail to appear.

The *pathogenesis* of this disease as shown by its symptoms is, in my opinion, as follows: the lacing up of the young girls' gracile, easily relaxing, and plastic body in corsets involves an increasing deformation and straitening of the lowest thorax aperture. This results in a shifting of the subdiaphragmatic organs. First of all the pressure acts upon the massive liver, and this again by its great weight serves to dislocate the organs lying below. Paul Hertz has shown us in a very fine manner how nephroptosis arises from corset pressure, because this utilizes the liver as a lever to tilt the right kidney out of its niche, and we therefore understand why in the majority of cases the floating kidney is only on the right side. But to what a still greater extent, and how more invariably must not the effect of the corset pressure on the liver extend to the stomach?

It is clear that if the liver is pushed down the stomach must follow suit, and hereby the œsophagus, the gastrophrenic ligament, and the cardial peritoneal covering *in toto* are stretched in a manner which corresponds with the extent of the subsidence. In this I perceive the cause of the invariable pains in the left side of the epigastrium, of which these patients always complain when they are up and doing, and especially so during meals. But, in addition, the posterior edge of the gastrohepatic and hepaticoduodenal ligaments must also become lengthened and dislocated. Together with the stomach, the transverse colon is pushed down, whereby more or less acute angled bends occur at the points of fixation at the hepatic flexure and the splenic flexure. This involves a hindrance of the passage of the fæces from the colon ascendens to the colon transversum, and, if they enter the latter, they will again be retained here for an abnormally long time, and then

the hard, gnarled fæces still further and continuously weigh down the transverse colon. Hence the ever increasing constipation.

I look for the cause of the virginal ptosis patients suffering so much more than the maternal ptosis patients do from pains and vomitings after meals to the circumstance that the tight abdominal wall and the narrow abdominal cavity do not permit of the free subsidence of the loosened organs. The result is that the stomach as well as the colon fold themselves transversely with the longitudinal axis, and breaks and bends occur which hinder the natural passage of the food and produce stasis and pains. The fact of the matter is, that all the vessels and nerves to the stomach from the large vessel- and nerve-roots have their course just between the peritoneal layers, which either form the suspensory ligaments or cover these. They form, so to say, an integral part of the suspensory ligaments and, when these are folded, are also subject to bends and folds, and when the ligaments are stretched and lengthened by the subsidence of the stomach a considerable drag is also exercised on the vessels and nerves. That such a distention of the sympathetic fibres and thereby of the ganglion cœliacum and of nervi-vagi, which, with the œsophagus, extend into the thorax cavity, cannot fail to affect the activity of these nerves seems evident, and here, surely, is to be found the explanation of many of the nervous symptoms of these patients. As regards the invariable pains in the left side of the epigastrium, it seems to me that these are explained naturally as having their origin in the drag on the sensitive nerves which have their course in the subperitoneal tissues.

In these conditions we have a simple explanation of the pains and disgorgements of the virginal ptosis patients immediately after partaking of food, and, if these symptoms become invariable, the consequent results are emaciation and waste of fatty and other tissues in the abdominal organs, which makes room in the abdomen for a further subsidence of the subdiaphragmatic organs, and makes the suspensory ligaments of these thinner and more relaxable. But, by this the subsidence

of the colon is increased, and the constipation by degrees becomes more obstinate. With the resorption of the stagnant fæces a poisoning of the organism arises—autointoxication, but this is not all, because the stagnation in the large intestine reacts on the function of the small intestine. The passage through the small intestine takes place more slowly, and, in certain cases, a real stasis may even occur in this. This may perhaps, as assumed by Lane, be due to bends in the small intestine at its points of fixation (the duodenal kink and the iliac kink) where the subsided part of the intestine joins the fixed part, or, as Knud Lunn thinks, may be only a result of the constipation, especially where valvula Bauhini are deficient.

According to Lunn's observations, then, it seems as if the stasis is transmitted to the stomach, and we then get the delayed emptying of this, five to seven hours after the meal, which often occurs with gastropotosis patients, and which is interpreted by certain authors as a "primary atony," and even by Stiller is considered as being the cause of the ptosis.

The view of the matter is entirely beyond the point, because in more than half of the cases of gastropotosis the emptying is perfectly normal. The delayed emptying, on the contrary, which occurs with the minority of ptosis patients seems to me rather to be explained naturally by the difficult conditions of passage in the large and small intestines.

The *diagnosis* of the virginal ptosis is generally not difficult for him who has once had his eyes opened to the peculiarities of the aspect of the disease, but for him who has not it offers many difficulties and stumbling blocks. Certain it is that few diseases are so frequently misinterpreted as this. The three wrong diagnoses under the flag of which virginal ptosis most frequently sails are (1) *ulcus ventriculi*, (2) *colitis*, and (3) *nervous disease of the stomach or hysteria*.

Those cases where violent cardialgia and vomitings occur as an immediate result of meals and dominate the aspect are naturally confounded with *ulcus ventriculi*. This confusion happens all the more easily because the violent and frequent vomitings by no means rarely show streaks of blood or even

such a strong admixture of blood that they assume the character of hæmatemesis. The presence of constipation, indeed, only strengthens the diagnosis, because it is so often a symptom with ulcer.

In addition to this the examination of the position of the stomach by scraping auscultation, or by Röntgenoscopy after a bismuth meal often reveals a subsidence which is inferior in proportion to the acute symptoms. With most cases, this seems to controvert the diagnosis, inasmuch as these cases mean quite plainly that the acuteness of the symptoms must be proportionate with the degree of the extent of the subsidence. Not until one has realized that it is just the circumscribed conditions of space which hinder the pressed-down stomach from freely sinking down and, on the contrary, jam it between the tight abdominal wall, the spinal column and the other abdominal organs, and force it to place itself in bends and folds, does one understand that these very circumstances, in spite of the apparently minor ptosis, produce such acute symptoms.

The differential diagnosis from ulcer is, as a rule, easily determined from the following facts (1) *The seat of the cardialgia* being to the left of the centre line, (2) that the cardialgia does not depend on the quality of the food, but does on the quantity of this. An ulcer patient suffers pain from eating rich, sour, spiced food, no matter how small the quantity, but stands milk, while a ptosis patient stands all such food equally well so long as the quantities are quite small, but suffers severe pain from milk and other neutral food when the quantity is too large.

(3) *The influence which the position of the body has upon the symptoms*. These always are worse in an upright position, and always improve and often disappear entirely only with confinement to bed.

The cases where constipation dominates the aspect of the disease, while the stomachic symptoms are comparatively minor, are often confounded with colitis. In many cases the confusion is promoted by this, that the constipation involves



in reality a colitis with periodically occurring diarrhoea. Here, also, it is a differential diagnostic symptom of great value. that with ptosis, confinement to bed has a highly favorable effect on the constipation, while constipation arising from other causes generally becomes more marked with confinement to bed

The diagnosis hysteria and nervous disease of the stomach is generally given with such patients as have for a long time been vainly treated with ulcer-therapy or anticonstipation treatment, partly because their having been vainly treated for a supposed organic disease leads to the diagnosis of functional neurosis, and partly because these patients, little by little, on account of their protracted sufferings and the fruitless treatment, become in a great degree psychically exhausted and nervous individuals. The differential diagnosis from hysteria is, however, by no means difficult, when one analyzes the history and the aspect of the disease, because it then always appears that constipation and dyspepsia have been the first symptoms and still constitute the central feature in the aspect of the disease. Scraping auscultation and Röntgenoscopy show us the presence of the ptosis, and, finally, an exact examination shows that really hysterical stigmata are practically always wanting.

More rarely the pure ptosis is confused with cancer. This happens with those patients who have become completely emaciated by vomitings and abhorrence of food, lasting over many years, and who have acquired a cachectic complexion from the autointoxication arising from the stagnating contents of the large intestine.

*Complications and Consequent Diseases*—Some of my observations indicate that the traction on the œsophagus of the subsided stomach may involve a difficulty with the swallowing and passing of the food, and thereby, also, changes in the œsophagus itself. It is peculiar to a rather numerous group of patients with virginal ptosis that they either permanently or periodically, especially when in an erect position, disgorge the food immediately after swallowing it. In other instances

I have observed the trouble with swallowing to be so serious that the patients have been admitted for stricture of the œsophagus. That these cases are really due to the traction of the stomach on the œsophagus seems proved by this, that the symptoms mentioned disappeared immediately and completely in all the cases after gastropexy or after the employment of an effective supporting belt.

As regards the stomach itself, the folds and bends mentioned, which, with virginal ptosis especially, are the result of the narrow space, give rise to serious and interesting complications and to the consequent conditions.

I have already mentioned that, even where no trace of ulcer can be proved at the operation, hæmatemeses are not quite infrequent with gastroptosis. Such hæmatemeses are probably due to stasis in and swelling of the mucous membrane at the places where the wall of the stomach is creased.

Finally, in a certain number of cases, the virginal ptosis leads to the development of an hour-glass stomach. I think, indeed, that I dare assert that the solution of the so long disputed question of the pathogenesis of the hour-glass stomach is to be sought for in the fixation of the creases of the prolapsed stomach caused by corsets and laces. The two theories which have hitherto stood in opposition to each other are, as is known, the conception that the hour-glass stomach is a congenital deformity as opposed to the ulcer-theory, according to which the hour-glass form should be due to cicatricial shrinkage. Without venturing to deny the justifiableness of these two explanations with individual cases, I venture distinctly to insist that neither of them can be accepted as accounting for the great number of this astonishingly frequent disease, because, if a congenital hour-glass is proved at all, it is proved, at the highest computation, only in one or two cases, of which the demonstrative force is doubted even by Moynihan, the advocate of the ulcer-theory. Now, as regards this, it may, when considered superficially, seem to be well founded in the fact that, with an hour-glass stomach, ulcerations or cicatrices are often found on the partition wall

But further reflection shows that the theory does not stand the test

The fact that we find an ulcer or a resultant cicatrix is really no proof that the ulcer is primary, because the hour-glass stomach itself, on account of the hindrance of the passage and on account of the stagnation and decomposition of the contents of the stomach, is greatly disposed to the development of ulcerations

Especially is there far more reason to believe that ulcer is secondary in the majority of cases where such ulcerations occur in the proximal part of the stomach. But in a great number of cases neither ulcer nor cicatrices occur!

There is, in addition another fact, which is generally overlooked by most authors and which entirely precludes the correctness of the ulcer-theory. What I am aiming at is this, that, while ulcer rotundum ventriculi is equally frequent with males and females, the serious forms which ought to be demanded for the development of such thorough changes are even more frequent with men than with women, the hour-glass stomach being such a rare phenomenon with men that it must most appropriately be called a female disease. Here, so to say, the conditions quite resemble those of gastropotosis. It was just this which directed my thoughts toward the possibility of the solution of the enigma, which the pathogenesis of the hour-glass stomach presents, lying in gastropotosis

The study of the clinical features and my operative experience have greatly strengthened this supposition. An investigation of the history of the disease as regards 26 cases of hour-glass stomach which I have personally observed shows that the first symptoms of the disease have always occurred during the years of puberty, when the subsequent, simultaneous misuse of the corset and the tight lacing commence. In their main features these symptoms entirely resemble those of virginal ptosis. Little by little the increasing hindrance of the passage, the retention, and the dilatation in the proximal part of the stomach are maintained as an aspect of the disease, and,

ing ulcerations, the aspect becomes more and more that of ulcer stenosis

By my numerous operations for gastropotosis I have been able to observe all the stages of the development of the hour-glass stomach, in consequence of which I have formed in my own mind a consecutive view of this

With virginal gastropotosis the bends of the creases occur essentially and naturally in two places (1) on the lesser curvature at the transition between pars cardiaca and corpus ventriculi in the very place where the triangular solid ligamentum gastrophrenicum (called by some pars condensamenti minoria) ceases and is relieved by the more elastic portion of omentum minus, (2) on the medial edge of ligamentum-hepaticoduodenale where the free portion of the duodenum (with the pylorus) bends toward the fixed part

The hour-glass formation is generally due simply to the fine adhesions which form themselves in the folds of the serosa surfaces which rest one upon the other (see Figs 1 and 2)

The development is sometimes greatly favored by this, that the omentum minus by coalescing with the omentum majus assumes a lace formation. With gastropotosis we very frequently find a complete loosening of the omentum minus, the central part of which subsides and hangs over the anterior side of the stomach like a tongue-shaped clump of the omentum. It may then come in contact with the tip of the omentum majus, and coalesce with this in a ribbon which draws a deep furrow in the stomach. The adhesion mentioned as occurring between the peritoneal surfaces, which I have seen in all stages, from those which commence extensively and are easily loosened to those which are hermetically soldered, fixes the ptosis creases, and these, like partition walls, protrude into the lumen of the stomach

I have dwelt so explicitly on the aspect and pathological importance of virginal ptosis because it is still so unknown and so misunderstood, though it is now 14 years since I described it for the first time. Far better known is the other form

## 2 THE MATERNAL GASTROCOLOPTOSIS

This is the form we find with women whose abdominal wall consequent to past pregnancies and confinements has become distended, roomy, and relaxed. Hereby the intra-abdominal pressure is altered, and the support which the air-filled intestines offered to the subdiaphragmatic organs as long as the vigorous elastic abdominal wall acted fails.

With women whose stomachs lie in a normal and secure position at the moment when the relaxation of the abdominal wall commences, it depends entirely upon the strength of the ligaments whether a gastropsis ensues at all. With strong women this does not occur, but with others, whose abdominal wall is less capable of resistance, a ptosis develops little by little, the development differing from the vaginal ptosis in this, that the coloptosis is generally primary. The transverse colon, which is no longer borne up by the small intestine pelotte, is weighed down by the heavy fæces so that it hangs like a downward convex festoon suspended by the two flexures. The pull firstly affects the gastrocolic ligament and the mesocolon, which are elongated and dragged downward. It is quite common to find the gastrocolic ligament elongated to 3-4 times its normal length, when it is quite thin and perforated in many places. Secondly, it affects the stomach, the suspensory apparatus of which is also little by little stretched and elongated. The constipation and accumulation of fecal matter in the colon resulting from the coloptosis affects with steadily increasing strength the downward drag on the colon and the stomach. It frequently happens that the heavy, fæces-filled colon lies right at the bottom of the pelvis and, like an anchor, holds the stomach fixed in its subsided position. Furthermore, the stomach can drag down with it the lower part of the œsophagus, and then we encounter gastropsis in its extreme form.

With maternal ptosis the aspect of the symptoms differs from that of vaginal ptosis in this, that the stomachic attacks—cardialgia and vomiting—are far weaker, are often, indeed,

absent. It is due to the far more favorable conditions of space, as the stomach is not jammed or liable to be folded and bent as is the case with the virginal abdomen. For the same reason these patients do not generally suffer the innumerable pains and nervous sensations which characterize the others. That it is the distinction as regards space which causes the difference in the aspect of the disease is quite clearly perceived in the transition of a virginal ptosis to a maternal ptosis. So soon as the first confinement is overcome, a great improvement occurs in the condition of the patient so far as these symptoms are concerned.

With maternal ptosis, the constipation with all its consequences is the dominant feature in the aspect. In course of time the effect of the autointoxication from the intestine reveals itself. The patient grows emaciated and sallow, suffers from headache and, in addition, from an ever-increasing sensation of subsidence, and from the unpleasant, depressing feeling that something is subsiding in the abdomen, and from an oppressive sensation of and feeling of fatigue across the loins. The drag of the subsided stomach on the cardia and the œsophagus causes constant pain in the left side of the epigastrium and, not unfrequently, difficulty in the passing of the food through the œsophagus, so that a spasm of the cardia may arise—similar conditions sometimes occur with secondary dilatation of the œsophagus.

It is characteristic of the disease that all these symptoms improve or vanish entirely with confinement to bed, while they at once recur or become worse with an upright position.

The coprostasis may attain such stages that attacks resembling ileus may occur, and in extreme cases the stomach may also become so loose that volvulus ventriculi may occur.

## II TREATMENT

When the surgeon has comprehended the correct nature of the disease, the question is whether the case lends itself to bandage-treatment or whether it demands an operative treatment.

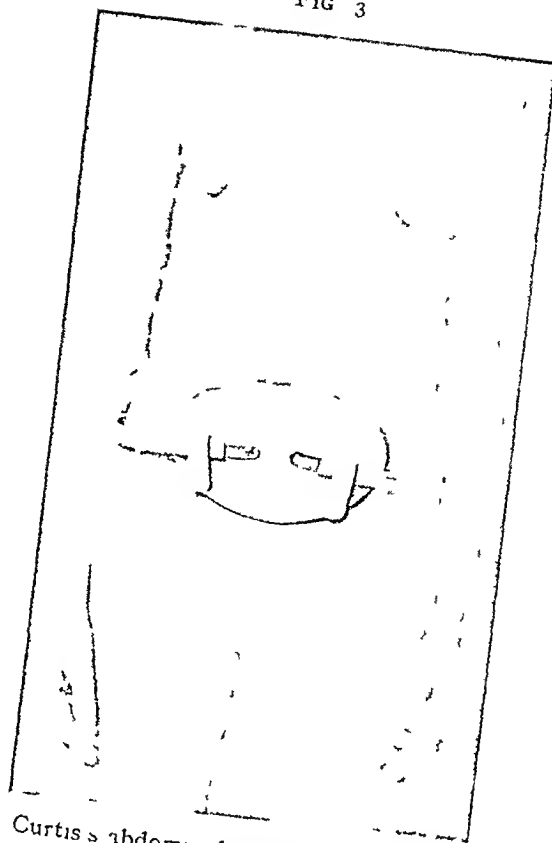
As regards the indication for the employment of a bandage, this varies greatly with the two forms of ptosis which I have described. While the majority of the maternal ptosis patients may be helped sufficiently with a good and rational bandage, with virginal ptosis patients one only quite exceptionally obtains an effect worth mentioning. This simply lies in the fact that the virginal abdominal wall is so muscular, vigorous, and elastic that, to overcome its resistance, such a strong pressure would be necessary as would be unendurable to the patient. With maternal ptosis, on the other hand, we are able to obtain good results through the relaxed thin abdominal wall with a good bandage.

An effective and good belt must comply with three requirements. (1) The pressure must act widely over the hypogastrium by aid of a large and rather firm pelotte, (2) the pressure must be powerful and invariable, and (3) one must be able to adjust the belt in a recumbent position in the morning, before the patient rises and while the organs still lie in their right position. For this reason all bandages which fasten at the back with laces are banned.

After many experiments I have returned to a copious, firmly stuffed pelotte, placed on a steel-spring belt in which, as with the English double hernial truss, the pressure is exercised by two spiral springs which are movably connected with the large abdominal pelotte in front, and at the back are supported against the sacrum or against the sacro-iliac symphysis by one or two small pelottes (Figs 3 and 4). These springs can be made as powerful as one wishes, and relax but slowly and slightly, when they are easily tightened again. But even this powerful belt, which I recommend as the best, is impotent with most virginal ptoses, as also with those particularly severe cases of maternal ptosis where the transverse colon has subsided right down into the small pelvis, and is on that account beyond the range of the belt, being squeezed rather than raised by this.

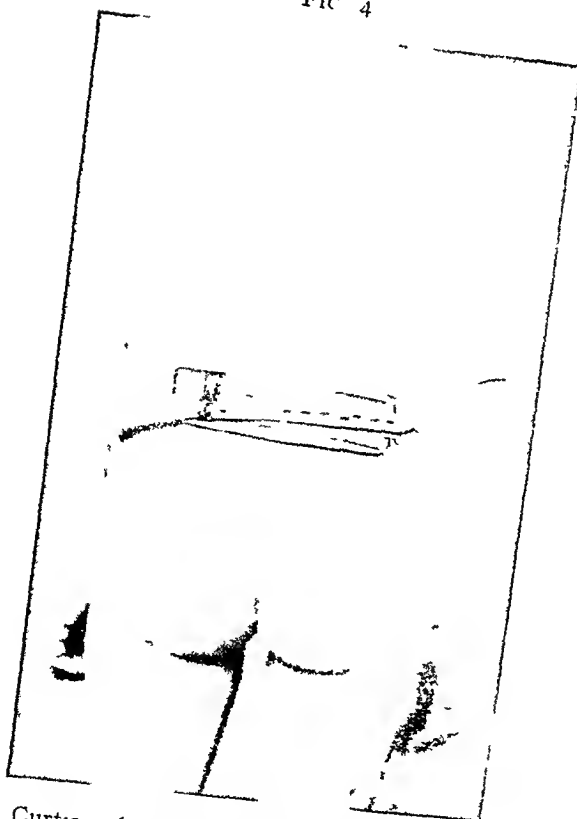
In all these cases, then, the only help for the patient is an operative encroachment which will raise the stomach and

FIG 3



Curtis's abdominal support front view

FIG 4



Curtis's abdominal support from behind





colon into their normal position. For the achievement of this object we are in the possession of various methods (1) direct gastropexy as it has been for the first time performed, independently of each other and after different methods, by Dupet and by Rovsing, and (2) the indirect operations which endeavor to raise the stomach, either by basting together and shortening the omentum minus as proposed by Stengel, Bier, and Beyea, or from below as with Coffey's operation which, by stitching the omentum majus firmly to the anterior abdominal wall, raises the stomach and colon.

If one were to choose *a priori* between these methods, the indirect operations would at first seem the more attractive, because with these one avoids fixing by adhesions an organ which needs mobility for its activity. Apart from the fact that adhesions in the peritoneum are for various reasons generally considered objectionable, one would think that a broad soldering of the anterior surface of the stomach to the abdominal wall must cause a considerable reduction of the motility and result in retention of the food, and it was just these objections and reasonings which led Beyea and Coffey to prefer the indirect operations. As the thought was also pleasing to me, I tried both methods, but have had to abandon them in favor of direct gastropexy.

Firstly, as regards Beyea's operation—the shortening of the omentum minus—this is in a great number of cases, and especially so in the severe cases which demand operations, technically impossible, because the omentum minus either no longer exists, or is so thin (as thin as tissue paper) and perforated that there can be no question of placing sutures in it. But even in those cases where the operation is possible, one generally gains only a temporary improvement or cure, because the same forces which have lengthened and weakened the ligaments continue to act, and by degrees the ligaments will again give way and the stomach will subside.

Coffey's operation seems to be more rational and better devised, because in many cases the omentum majus is strong and well preserved, and because, owing to its being fastened

to the anterior abdominal wall, a raising of the greater curvature as well as of the transverse colon takes place and, in addition, a stretching of the mesocolon transversum on which the stomach normally rests. In Coffey's hands this operation seems also to have given fine results.

In the cases where I have attempted this operation, it has answered most satisfactorily during the period immediately following it, but in the course of a few months the patients have returned, suffering in part from the old symptoms and in part from new ones arising from omental adhesions (pains, constipation, diarrhoea). The reasons for this are first, that the omentum can be fastened to the sides of the centre line only in an inferior degree, and that for this reason there is room for a subsidence of the fundus of the stomach in the left side, and then a bend between the free part and the fixed part easily occurs, second, that the omentum is very slack, and its adhesions therefore easily drawn out into long bands which present the danger of ileus.

Notwithstanding the theoretical attraction of the indirect operations, I must in accordance with my experience advise direct gastropexy as the safest and best method.

When, in 1897, I thought for the first time of performing gastropexy with a patient who was admitted with the diagnosis of cancer of the stomach, but who only showed gastropptosis pure and simple, it appeared from an inspection of the literature that such an operation had been performed once before by Duret, of Lille, in accordance with the method here portrayed. He made an incision through the skin and the muscles to the umbilicus from the ensiform process, but incised the peritoneum only in the lowest half of the wound, and then fixed the lesser curvature of the stomach to the untouched upper part of the parietal peritoneum with the aid of a single silk thread. This was led in and out alternately through the serosa of the stomach and the parietal peritoneum. The ends of the thread were conducted out through the recti muscles, and were tied subcutaneously over these. The method did not meet with my entire approval, first, because a single thin silk thread seemed to me too insecure a fastening, and

in the next place because I found it precarious to fix the pylorus, which normally should lie deep down and be mobile, to the anterior abdominal wall, and finally because the tying of the silk threads in the centre line must inevitably involve a serious shrinkage and folding of the lesser curvature. In that first case I at once employed the method which I firmly recommend as being the best. Parallel with the lesser curvature I lead three strong silk threads in and out through the serous coating of the anterior surface of the stomach, leaving the pyloric portion free. The upper thread is placed close under the lesser curvature, and the two others, with an interval of about 2 cm., are placed in such a way that the greater curvature and a rather large piece of the wall above this are left free (Fig 5). With a fine needle the serosa coating between the threads is now scarified in all directions, also the surface of the parietal peritoneum, and eventually that part of the under side of the liver to which one wishes the stomach to adhere. The ends of the silk threads are led out through the entire thickness of the abdominal wall, that on the left as far as the side of the rib-curve, and that on the right at about 3 cm. to the right of the centre line. The peritoneum is now joined with catgut, and the fascia and skin with aluminum bronze, and, after the line of wound has been covered with collodion and cotton wool, the silk sutures are tied over a glass plate covered in sterile gauze (Fig 6), the dimensions of which are a little larger than the stomach surface which has to be fixed. In this way it follows that the anterior surface of the stomach lies flat and close to the abdominal wall, without shrinkage and folding. These threads are left for four weeks and are then easily removed. A perfectly secure and solid adhesion is thus obtained.

After having employed this method with excellent results in 90 cases I allowed myself, in 1907, to be induced by Cannon's investigation as to the importance of the prepyloric part of the stomach with regard to the mechanical manipulation of food to modify my operation in such a way that I left the entire prepyloric part free, and only fixed the fundus with the aid of three silk threads, which passed transversely over the axis of the stomach and which were tied over a glass plate to the left of the centre line. With the systematic after-examination of all the cases treated with gastropexy up to January 1, 1911, the results from the latter method have proved to be far inferior to those of the

former, because while the former gave 60 complete cures in 94 cases, the latter gave only 29 cures in 69 cases. For this reason I have returned to the former method, and have employed it with my last 30 cases, the results so far being excellent.

Since 1897, when I performed my first gastropexy, till January 1, 1911, I have myself performed the operation 163 times, and have received information from other Scandinavian surgeons of 93 operations performed in accordance with my method. All these 256 patients have been traced and their condition since the operation carefully examined, with the following result:

#### ANALYSIS OF RESULTS OBTAINED IN 256 GASTROPEXIES

	Per cent
Complete cure	162 = 63.2
Great improvement	33 = 12.8
Improvement	15 = 7
Slight improvement or no change	32 = 12.8
Deaths	11 = 4.6

On separating my own statistics of 163 cases I get

	Personal statistics Per cent	Statistics of Scandinavian surgeons Per cent
Cure	92 = 56.6	70 = 75.2
Great improvement	24 = 14.7	9 = 9.6
Improvement	18 = 11	
Slight improvement or none	21 = 12.8	11 = 11.8
Deaths	8 = 4.9	3 = 3.2
Total	163	93

First, as regards the mortality, it may well be said that a mortality of 4.6 per cent is *per se* small. But on analyzing the cause of death in the individual cases the real mortality from gastropexy proves to be far smaller.

As concerns my own patients, two died a fairly long time after the operation from tuberculosis of the lungs, while four extremely exhausted patients died from bronchopneumonia during the week following the operation, but without any morbidity at all in the peritoneum.

On the other hand two died from ileus, the one from

a duodenoventricular ileus due to the strangulation of the duodenum over an old adhesion, the other from ileus of the small intestine due to an accidental strangulation of a coil of the bowels over an old adhesion due to an old hysteropexy

As regards the three deaths mentioned in the statistics of the other Scandinavian surgeons, two of them had absolutely nothing to do with gastropexy as such the one was due to a casual perforative appendicitis, the other to bleeding from a gastro-enterostomy performed simultaneously with gastropexy In the third case, however, death must be ascribed to gastropexy, inasmuch as it was due to ileus of the stomach, the result of the hepatopexy having been neglected, the sunken liver then rode over the pyloric part of the fixed stomach

The mortality with gastropexy proper is then 3 in 256 or 1 17 per cent

As regards the recoveries, 71 or 75 per cent of the patients were cured to the extent of being relieved of their pains, of regaining a healthy appearance and their strength, and, from being incapable, depressed, miserable wrecks, of becoming able-bodied, healthy, and happy people

I wish to draw special attention to this, that *gastropexy in 76 of my 163 cases has freed the patients of their constipation of many years' standing, which had proved intractable to any other treatment*

All these cases were equally severe, and some were more serious than those for which Arbuthnot Lane advised extirpation of the colon or ileosigmoidostomy operations the dangers of which are extremely great as compared with those of gastropexy

There then remain about 25 per cent of the cases where the effect of the operation has not been satisfactory in 11 per cent the condition was improved considerably, but in 12 8 per cent the improvement was quite insignificant or nil As regards the cause of the bad results, an analysis of these cases warrants the hope that still better results may be attained in the future

Here I shall first point to the circumstance that during a

period which comprises 73 cases. I employed, from fear of fixing the prepyloric portion, a method which a revision of the results has proved to be greatly inferior to my original method, inasmuch as the cures were 20 per cent less in number. It is obvious that a future systematic carrying out of the original method of operation by a broad joining of the stomach to the abdominal wall will improve the results considerably. On other points, also, a change in the method of operation will effect improvement in the results.

In all cases where the gastrocolic ligament is considerably elongated, one does not obtain by gastropexy pure and simple a lifting of the colon sufficient to remove the constipation.

In order to obtain this a special operation is required, and some of my less successful cases in earlier days are surely due to my non-appreciation of this and to later experiments with various inferior methods. Here, the right operation has proved to be the *shortening of the omentum and the mesocolon* by basting this with the aid of a row of thick catgut threads, which commence in the serous coating of the colon and end at the greater curvature (see Fig 7). For me this has proved to be the ideal method as against the colopexy and the omentopexy to the anterior abdominal wall, because, while these restrict the mobility of the large intestine and in addition often cause adhesions, the shortening of the mesocolon and the omentum raises the intestine without restricting its mobility. The result seems to be permanent. A systematic employment of this little operation as an accessory to gastropexy in all cases with an elongated gastrocolic will increase the number of the entirely cured.

In some cases an imperfect diagnosis has been the cause of the bad result, as, for instance, the overlooking of an ulcer in the stomach or in the duodenum or of cancer in another organ. The improved diagnostic methods, and especially gastroduodenoscopy, will probably decrease the number of such mistakes in the future.

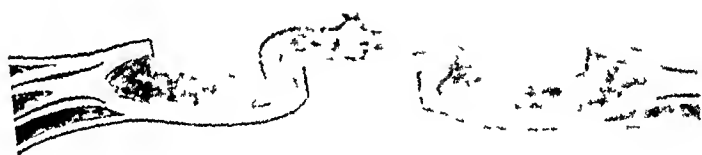
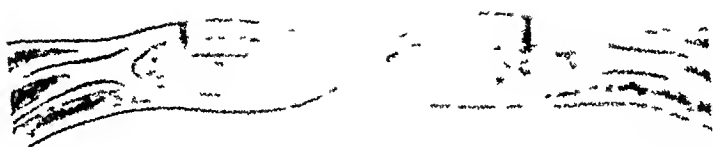
Finally there is a very important point which explains the difficulty of obtaining in many cases a complete cure for

FIG 7



Author s method of shortening the gastrocolic ligament





Author's method to enlarge the abdominal aorta

these patients, viz, the many consequences of enteroptosis and lacing which are co-ordinate with gastro- and coloptosis. First, the straitening of the lowest aperture of the thorax may be so considerable that there is no longer any room at all for the liver and the stomach, and therefore it is impossible to fix the stomach in a satisfactory manner without jamming it, just as it is impossible to get the colon sufficiently raised and to straighten out its folds and bends.

Even if the condition of the patient improves somewhat, the pains and the constipation in particular will nevertheless continue after the gastropexy.

Where the stomach is concerned, I think that one may obtain better conditions, partly by giving up any idea of its reposition, inasmuch as one fixes it lower down where there is room for it, and partly by making the abdominal cavity more capacious with a plastic enlargement of the abdominal wall. In no insignificant number of cases of gastroptosis one finds the space above the umbilicus so contracted that one has the greatest difficulty in inserting a finger between the vertebral column and *musculi recti*, if one fixes the stomach up here where it ought normally to lie it is jammed.

In such cases I have attained an excellent result by doubling the width of *musculi recti* in the following manner. Of the anterior blade of the rectus sheath and the anterior muscular layers I have formed rectangular lobes with their base at the medial edge, which lobes I have then joined in the centre line (Fig. 8).

If it is difficult in such cases—which always belong to the virginal type—to make room for the stomach, it is generally impossible to do so where the colon is concerned. Here the bends at the *flexura* become sharper and sharper, and become fixed by adhesions between the serosa surfaces at the angles. The constipation becomes more and more obstinate and invincible, and the autointoxication and pains render these patients utterly miserable.

Here, in this fortunately small group of cases, is, according to my experience, the real indication for Arbuthnot Lane's

“shortening” by ileosigmoidostomy, which I have employed with excellent result in two otherwise quite desperate cases. It was most interesting to notice how the abhorrence of food and the malaise of many years’ standing of these patients were succeeded by a ravenous, almost immoderate appetite. With one of these patients the purgation showed a tendency to turn into diarrhoea, which, however, I was able to keep in check by dieting.

What still has great influence on the results of gastropexy is the ptosis of other abdominal organs, above all of the liver and the kidneys which is so frequently present.

That a considerable hepatoptosis prevents a good result from gastropexy is evident, because, when the patients get up after the operation, the liver falls and lies across the stomach and its supports, which may not only cause pains but may also cause ileus of the stomach, as was the case with one of the deaths reported by Hertel.

Therefore, with attendant hepatoptosis, hepatopexy should always be performed simultaneously with gastropexy. How frequently this is indicated is seen by my having had to perform hepatopexy in no less than 68 of my cases. I perform this in part directly with silk sutures which fasten the serosa covering on the convexity of the liver to the diaphragm, and in part indirectly with the aid of the ligamentum teres. This is severed after a double ligature, and the topmost end sewn to the diaphragm with strong silk thread, whereby the liver is raised up. It is of great importance that hepatopexy shall be performed very substantially with wide scarifications, in order that the heavy organ shall not tear itself loose again, and sink down on the stomach.

Sometimes the lacing involves the development of a large hypertrophied left lobe of the liver, which pushes against the curvature minor, and thus makes impossible the replacement of the stomach in its normal position.

In four cases I have been obliged to remove such a lobe of the liver by resection, in order to be able to perform gastropexy.

I perform the resection without loss of blood by simply pinching in two the liver tissue at the base of the lobe with Roux's angiotribe. Only the peritoneum holds, while the liver tissue bursts, and the vessels of the latter do not bleed. The large vessels are seen projecting from the surface and can easily be tied for the sake of safety. The peritoneum is then joined across the broken surface of the liver. If the peritoneum should burst or be insufficient for the covering of the surface of the wound, I transplant a piece of the omentum for the purpose.

In some few cases where pains and constipation remain after gastropexy, this is due to the prolapse of one or both kidneys, and the patients do not then recover entirely until after a nephropexy. With 10 of my cases it is not until after a unilateral or a bilateral nephropexy that I have succeeded in attaining an absolute result. A right-sided nephroptosis, especially, often involves a prolapse of the ascending colon and a pressure on the cæcum, thereby keeping up the constipation and pains.

In certain quarters there has arisen an inclination to maintain that the only operation which could be indicated with gastroptosis is gastro-enterostomy, because the vomitings and pains must be due to difficulty in the passing of food, "atony" and dilatation of the stomach. Now it is quite correct that, in a certain number—about 50–60 per cent—of gastroptosis cases which require treatment, a slight delay in the emptying of the stomach occurs, so that this is completely emptied only after 5–6 hours. This delay is, however, by no means due to "atony," the muscular organs of the stomach really being in perfect order and prepared to act so soon as the stasis in the bowels, which is due to the constipation and to the ptosis bends on the large and small intestines, is removed.

Therefore gastro-enterostomy is never indicated with a simple gastroptosis, experience even showing indeed that it is a highly injurious operation, inasmuch as not only do the existing symptoms deteriorate greatly but an entirely new complex of symptoms also supervenes—nausea and gall-

vomitings This is simply due to the fact that gastro-enterostomy does not at all strike at the cause of the stasis, which lies in the large intestine and far down in the small intestine at the opening into the cæcum, but, on the contrary, instead of removing the drag and the weight which the subsided stomach exercises, only increases this further, and a bend will very easily arise on the subsided folded coil of the anastomosis, which leads to a more or less pronounced *circulus vitiosus*

Gastro-enterostomy, then, only increases greatly the sufferings of the ptosis patients, and even reduces them to a condition of extreme emaciation and misery At one time or another I have had eight such patients under treatment With four of these I have obtained a complete cure and with the other four a very great improvement by separating the intestine and the stomach at the point of the anastomosis, and, after having individually closed these, by performing gastropexy

Therefore it is of extreme importance distinctly to diagnose between ulcer and gastropptosis Because, excellent as the effect of gastro-enterostomy is with ulcer stenosis of the pylorus, just as injurious it is with a simple ptosis Even if there is ulcer with ptosis without stricture of the pylorus, my advice, in accordance with my own sad experience, is entirely opposed to gastro-enterostomy. If the ulcer is small, and situated on a ptosis fold, one has to be content with a simple gastropexy, which then generally leads to the ulcer being healed If the ulcer is large and infiltrating, it should be removed by excision

I have chosen to discuss in this paper the pathological importance and treatment of gastrocoloptosis because, although it is extremely common the world over, and in spite of its turning a very large number of individuals, females in particular, into disabled, tortured, pitiable invalids, it is still greatly misunderstood and incorrectly treated

It is of importance to surgeons to know that the disease is in a number of cases confounded with ulcer ventriculi and

cancer ventriculi, in order that they neither perform a useless, often injurious, gastro-enterostomy or close the incision, disappointed at not finding the anticipated ulcer or cancer, but perform the simple encroachment of gastropexy which alone can cure these patients.

It is of far greater importance to draw attention to the fact that the majority of these cases do not reach the surgeon, because the doctors, confounding cause with effect, enroll them under hysteria and neurasthenia, because they consider the stomachic and intestinal symptoms to be the outcome of a nervous, degenerative disposition, while, in reality, all the nervous symptoms are a result of ptosis and constipation. These patients wander in vain from doctor to doctor and from treatment to treatment, without finding relief. Small wonder that they become more and more nervous, and finally give one the impression of being above all neuropathic individuals.

If physicians the world over could have their eyes opened to the right diagnosis and treatment of these symptoms, an extraordinarily large number of suffering, disabled persons might regain health and strength by a bandage-treatment or by gastropexy, and the physicians would be relieved of the most ungrateful and wearisome patients.

## A NEW PRINCIPLE IN ŒSOPHAGOSCOPY AND GASTROSCOPY.

BY RICHARD LEWISOHN, M.D.

A VAST literature has accumulated on the subject of œsophagoscopy and an enormous amount of energy has been expended in the last two decades in the construction of new œsophagoscopes. In spite of these facts it must appear obvious to one who has investigated the matter that œsophagoscopy has as yet not received recognition as one of our safe and reliable diagnostic methods. There is no question that in a large proportion of œsophageal affections, as for instance strictures, neoplasms, foreign bodies, etc., a visual inspection is of the greatest advantage to the patient as far as the diagnosis and therapy are concerned. Let me remind you of the unexpected results that have followed the introduction of the cystoscope into urology. Is it not surprising that œsophagoscopy should have been so slighted by comparison, notwithstanding the fact that there has been no lack of effort in this direction and that the first attempts to inspect the œsophagus date as far back as those to inspect the bladder?

We can only explain this disproportion by the fact that as yet it has been impossible to construct an œsophagoscope that can be used with the same safety and reliability as the cystoscope. It is not that there is no demand for such an instrument. At first many were disposed to reject the cystoscope, and yet after a short time cystoscopy was generally adopted.

The great number of instruments heretofore constructed fall into two distinct groups (1) straight tubes, which are introduced with the head in hyperextension, (2) jointed tubes, which are only straightened after their introduction into the

œsophagus For the sake of brevity I shall only refer here to the two main types of œsophagoscopes that have been used up to date Whoever wishes more detailed information is referred to the exhaustive historical review of the subject in Starck's "*Die direkte Besichtigung der Speiseröhre* *Œsophagoscopie*," Würzburg, 1905

The main exponent of the straight tube was v Mikulicz, who began his researches as long as thirty years ago The construction of these tubes is extremely simple, irrespective of whether the light is thrown in from without (v Mikulicz), or whether the illumination is placed at the distal end of the tube (Jackson) Obviously, difficulties in construction cannot be held responsible for the fact that these instruments are not in general use As an example that these instruments, in spite of their simplicity, are still unpopular, let me call your attention to the fact that the large majority of surgeons even to-day prefer to remove a foreign body by means of an external œsophagotomy instead of via the œsophagoscope This proves rather conclusively that the introduction of these instruments is associated with the greatest discomfort, nay even danger, to the patient The instruments of this type do not take into consideration the normal rectangular formation existing between the oral cavity and the œsophagus, which is only partly obliterated by hyperextension of the head The introduction is frequently very difficult even when the teeth are missing, and when they are well preserved it is often impossible Thus, some authors even go so far as to recommend the extraction of one or more teeth to make the introduction possible! I, personally, had the opportunity of examining an œsophagoscope which had been introduced by one of my colleagues and which distinctly showed the dental impressions in the hard steel It is small wonder that patients will not tolerate such discomforts—to put it mildly

So much for the discomforts What, then, are the dangers of the straight tubes? It is well known that their use has been followed by a large proportion of perforations of the œsophagus, which resulted fatally One of the reasons for this is that



the tube cannot be inserted in the longitudinal axis of the œsophagus even if the head is in extreme extension. There always exists a more or less obtuse angle between the tube and the œsophagus, and thus it is easily possible, especially when a certain amount of force is used, to crush the œsophagus against the spinal column and perforate it (Fig. 1)

The same danger exists with the second type, the jointed tube. This tube is constructed of a number of hinged joints, which after their introduction either snap into place automatically, or by means of a wire are pulled straight. In spite of the fact that it is not necessary to hyperextend the head with this instrument, its introduction is by no means easy and devoid of danger. Here also an angle is formed between instrument and œsophagus which makes its introduction difficult. Another difficulty is offered, which the accompanying diagram (Fig. 2) clearly illustrates. When one tries to introduce the instrument into the deeper parts of the œsophagus, one meets with considerable difficulty as soon as the instrument strikes the posterior wall of that organ and impinges on the spinal column. The instrument will no longer glide downward in direction of the arrow *c*, but points *a* and *b* will simply be approximated and the curve of the instrument increased, while the instrument sticks fast. These are not merely theoretical considerations, for in the beginning of my studies I experimented for several months with various tubes which I constructed upon this principle.

On the basis of these observations and experiences we must conclude that a satisfactory œsophagoscope must fulfil the following three main requirements

- 1 The introduction must be possible in the normal position of the head
- 2 The instrument must be so constructed that it actually passes in the longitudinal axis of the œsophagus and not at an angle to this axis
- 3 The œsophagoscope should only be passed downward along the œsophagus under guidance of the eye to avoid perforations

FIG 1

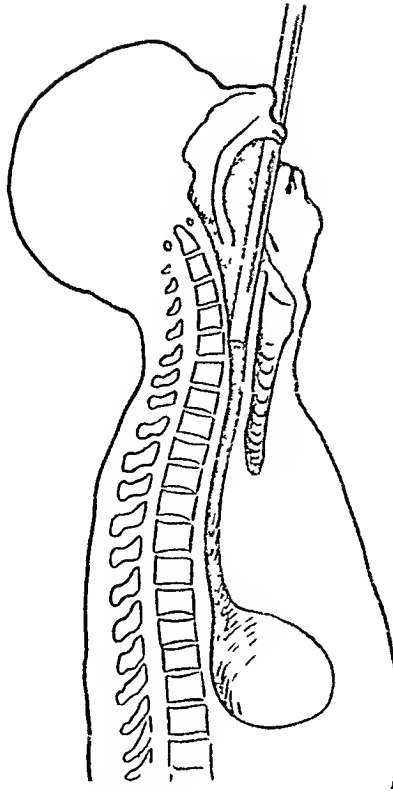


Diagram showing disadvantages and dangers of the straight tube

FIG 2

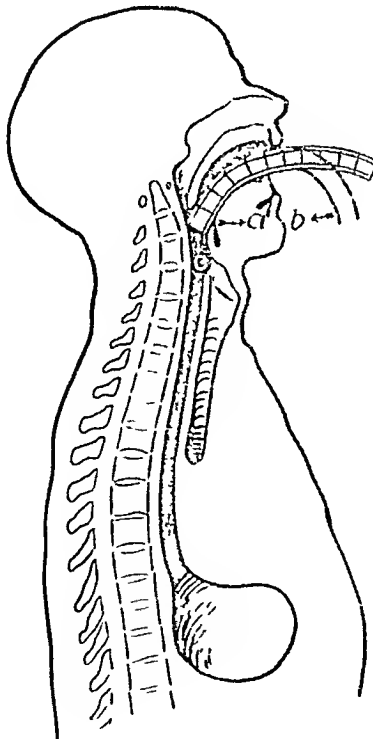
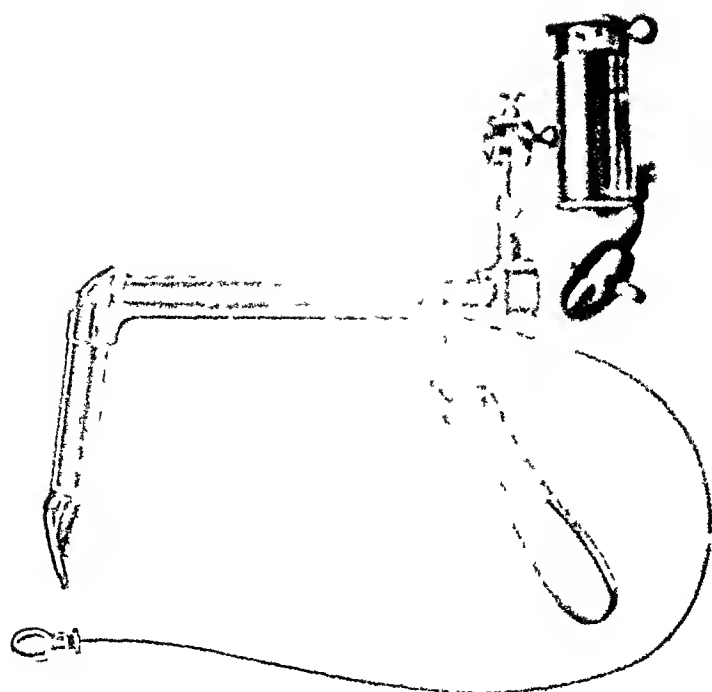


Diagram showing difficulty in introducing jointed tube



Rectangular telegraph or signaling apparatus

Fig. 1

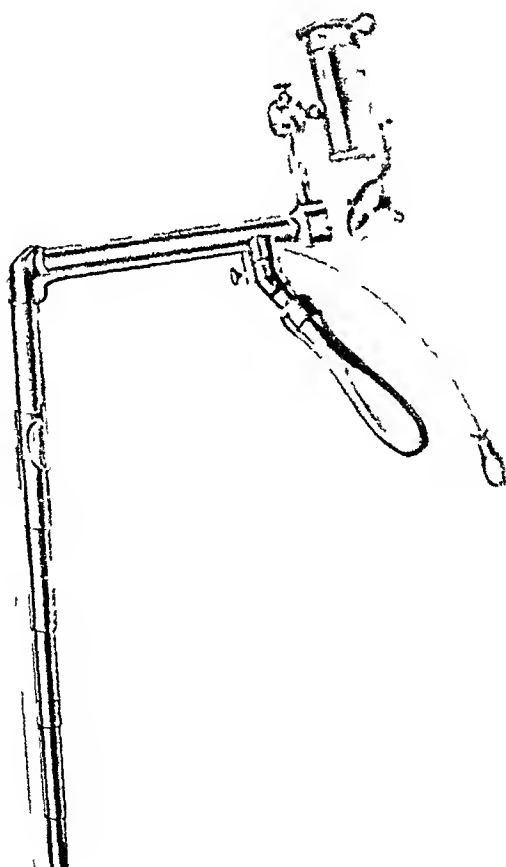
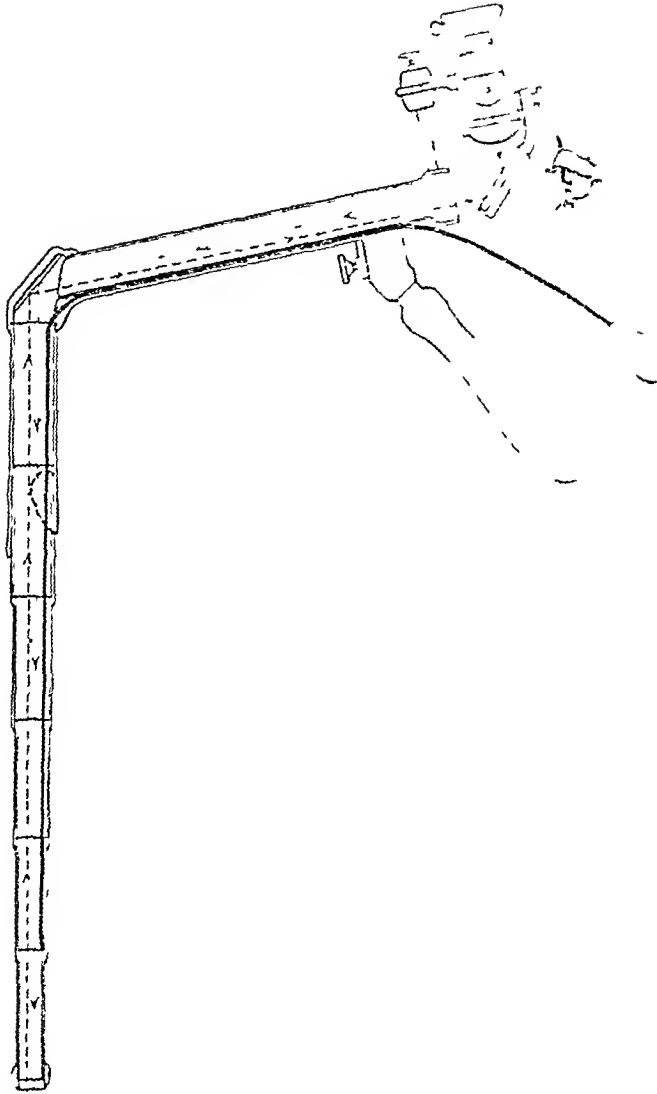
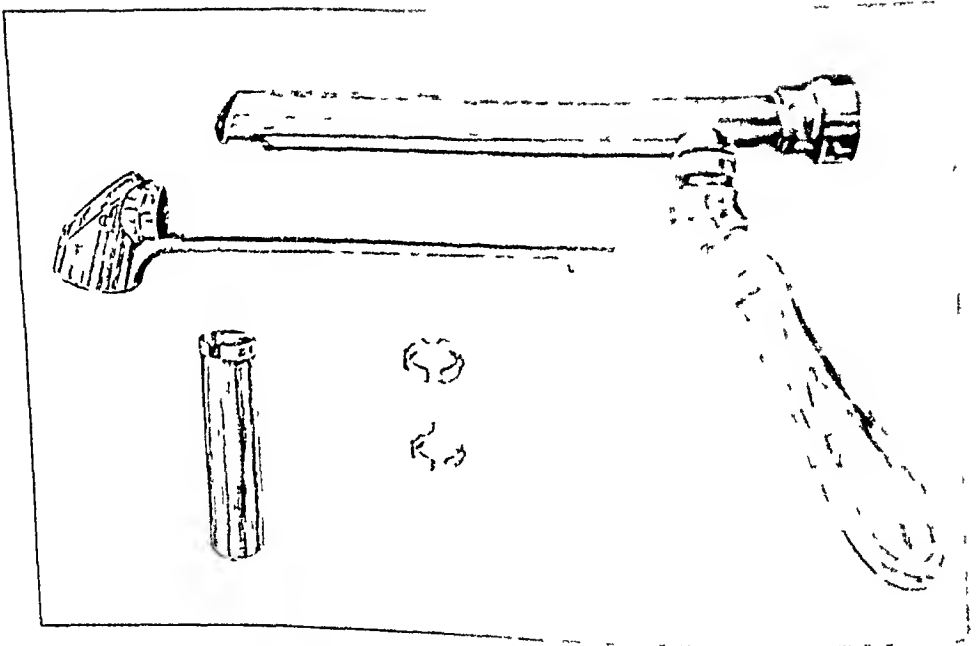


FIG 5



Diagrammatic sketch of the œsophagoscope, showing the directions of the œsophagus.



Sketch of separate parts of the aphnoscopes

FIG 10

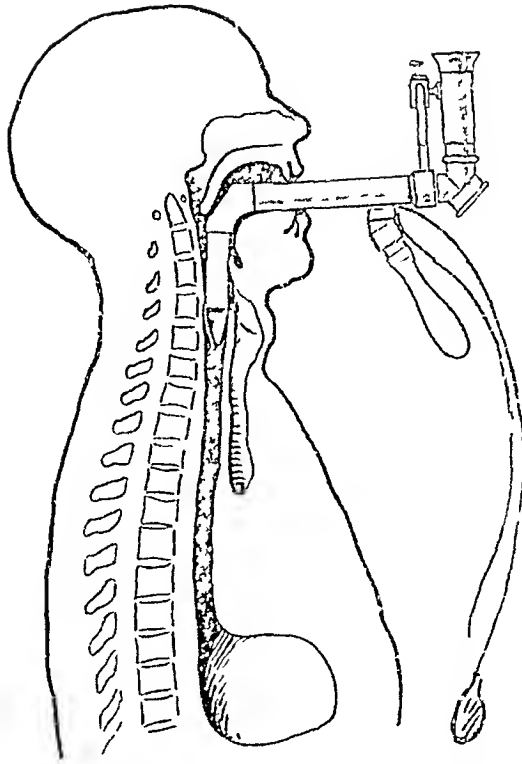


Diagram showing cesophagoscope in position with telescope closed

FIG 11

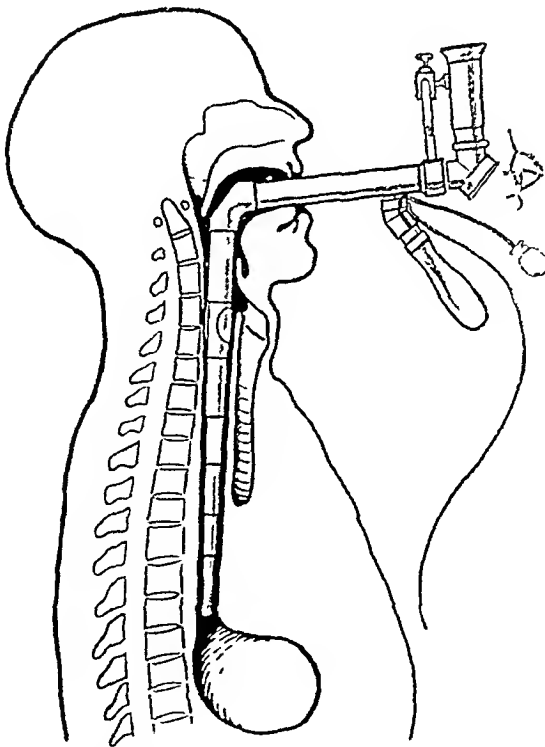


Diagram showing cesophagoscope in position with telescope opened



Introduction of a 20 ft. esophagoscope

Fig. 2



Esophagoscope in position

FIG 10

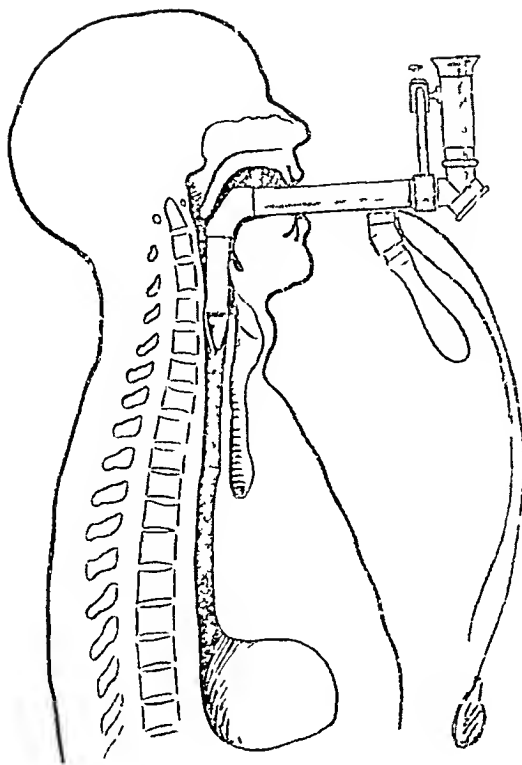


Diagram showing oesophagoscope in position with telescope closed

FIG 11

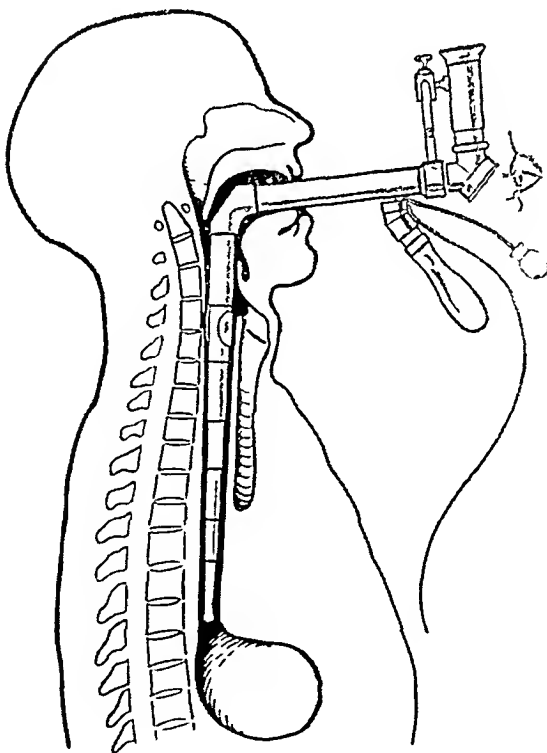


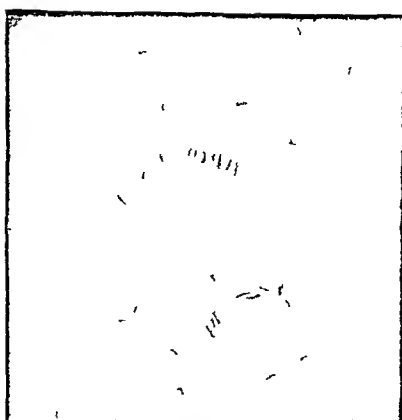
Diagram showing oesophagoscope in position with telescope opened







1



2



3



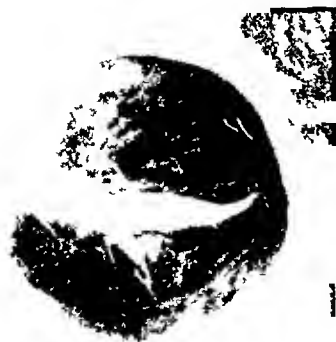
4



5



6



7



8



Based upon these three main considerations I have constructed an instrument in the following manner

The instrument consists of two portions which are joined together at almost a right angle, first, the horizontal portion which lies in the mouth of the patient during the examination, and second, the vertical portion consisting of a telescope composed of six separate tubes which may be pushed down into the œsophagus as far as necessary (Figs 3 and 4) The horizontal portion consists of two parts which are represented in Fig 6 These two parts can easily be separated by traction in a horizontal direction These two parts each carry a semicylindrical canal When the two parts are combined, the canals form a tube In this tube the spring, which is necessary for the manipulation of the telescope, rests In this way this spring lies entirely outside of the main horizontal tube and does not disturb in any way the passage of the light rays

At the proximal end of the horizontal tube, which, of course, lies outside of the mouth, is attached the illuminating apparatus This consists of a lamp and condenser (Fig 5) I use a Tungsten lamp containing three crossed filaments This lamp is copied from the one constructed by Fischer of Freiburg, but it gives a much more intense light An exceptionally strong source of light is necessary for my instrument, because, as can be seen from Fig 5, the light is broken three times before it reaches the eye of the observer Naturally, therefore, much more light is lost than with the straight œsophagoscope where the ray is not interrupted at all or, at most, once The street current is adopted for the light by means of a rheostat Inasmuch as the lamp is well insulated, one need not fear a short circuit Directly under the lamp a condenser is placed which concentrates the rays The rays then fall on a mirror (Figs 3 and 5) which is movable on a horizontal axis From this mirror they are thrown to a second mirror which lies at the junction of the horizontal and vertical portions of the instrument This second mirror interrupts the rays in such a fashion that they fall directly downward in the telescope The return of the rays to the eye of the observer is clearly shown in Fig 5 The picture is inverted but not reversed

I use the thinnest possible quartz mirror As a result of the thinness, the loss of light on account of penetration of the glass is minimal and a quartz mirror polarizes light much less than the ordinary mirror, which fact also adds to the brilliancy of the light The distal mirror is easily removable, so that it can be cleaned The vertical part of the telescope is attached by means of a thread to the horizontal portion To separate the telescope from the horizontal part of the instrument, it is first necessary to unscrew the olive at the end of the spring and to detach the screw lock that holds the two separate portions of the horizontal part together The horizontal tube is then pulled out (Fig 6) and the carrier of the distal mirror is then unscrewed from the telescope by means of a key The part holding this mirror is then lifted off and nothing but the telescope with the spring attached remains

silk and catgut About two feet of colon and ileum was removed The ends of the severed intestines were sutured with continuous suture of catgut, after being tied with No 3 chromic catgut ligature A loop of the side of the ileum was caught between clamps and another caught in the transverse colon near splenic flexure and a lateral anastomosis made The peritoneal surfaces were sutured together with heavy silk sutures

CASE II—E H, thirty-one For past two years has had intestinal indigestion Since early summer has had attacks of obstinate constipation lasting 6 to 8 days and attended with considerable abdominal pain and cramping when bowels moved During last month has vomited after pain which is severe over lower abdomen Has lost about 25 pounds

*Operation*—Patient etherized A six inch incision was made through abdominal wall vertically, about 1 inch to right of umbilicus and extending from 2 inches below umbilicus to 4 inches above umbilicus The colon was drawn out through this incision and was found to have a very long mesocolon The ascending and transverse colon were greatly dilated and sacculated, and contained many hard fecal lumps The descending colon was found to be greatly atrophied Numerous small linear scars and adhesions were found along the course of the colon The ileum was clamped with two clamps about two inches from the ileocæcal junction and cut between The two ends were covered with hot wet packs and laid aside The mesocolon was then clamped in sections and cut, freeing the colon from the ileocæcal junction to the sigmoid It was here clamped with two clamps and cut between and the colon removed All clamped portions of the mesocolon were then ligated with catgut and dropped back into the abdomen The end of the ileum was then ligated, cut, cauterized with pure carbolic acid, and inverted with a silk purse-string suture The end of the sigmoid was treated in like manner A lateral anastomosis was made with Major's clamps about two inches from the ends The back portion of the anastomosis was sutured with a silk inversion suture The gut was then opened and an anastomotic suture of catgut closed the opening joining the two parts The inversion suture was then completed A few more interrupted silk sutures were then made to further invert the gut and strengthen the anastomosis

DR JOHN B DEEVER believed that Mr Lane was correct to

above with a diameter of 18 mm. There is sufficient room in the œsophagus to do this. This would add another 5 cm. to the telescope and it would be possible in a suitable case to even pass the instrument into the stomach and thus to attempt a direct gastroscopy. From its point of emergence from the horizontal portion of the instrument (Fig. 3) the spring is marked at intervals of 5 cm., so that one can easily tell how far the telescope has been passed into the œsophagus.

In order to clean the telescope, I advise its complete separation into its individual portions, a thorough cleansing of each part with benzene, sterilization by boiling, and lubricating with vaseline before reassembling the parts.

Without going too much into detail I might mention here that it is possible in examining high lesions in the œsophagus that one may not need to use all six tubes. One might reduce the thickness of the instrument and at the same time increase the field of vision, if one had three sets of tubes to be used according to the height of the lesion. The following combinations would be practicable: 1, tubes 1-6 inclusive, 2, tubes 2-5 inclusive, 3, tubes 3 and 4.

On account of the right angular construction of the instrument and the rings which protrude into its lumen, it became necessary to construct an aspirator which differed somewhat from the one in ordinary use (Fig. 7). The rubber tube is carried over the right angle by means of a spring resembling the Albarran finger of the cystoscope which is attached to a metal tube through which the rubber tube is passed. That the rubber tube does not catch on the rings, a small perforated metal button is attached to its distal end. The outer end of the rubber tube is attached to an aspirating bottle. With this instrument the aspiration of mucus is as easy and certain as with the straight tube.

I shall not say much here about the forceps which I am now constructing. Certain changes are necessary for it to compete in usefulness with the forceps that is used with the straight tube. I am convinced from my previous experiments in this direction that this problem will soon be solved. I hope to be able to present this forceps in a later publication, and also to describe a bougie that can be used with my instrument.

The method of examining the patient with my new instrument is as follows. The patient sits on a chair, the head being supported by an assistant. The pharynx is anesthetized with a 10 per cent. or 20 per cent. solution of cocaine. The introduction of the œsophagoscope is accomplished in two stages.

#### 1. *The "anchoring" of the instrument in the œsophagus*

The examiner stands in front of the patient, and while he draws the tongue out lightly with the left hand, pushes the instrument with the right hand to the posterior wall of the pharynx (Fig. 8), keeping the instrument exactly in the

middle line of the head. When the distal extremity of the instrument touches the posterior pharyngeal wall, the handle must be gently elevated, until the ocular comes into a horizontal plane. In this way the instrument glides automatically over the epiglottis and arytenoid cartilages, and the two metal guides at the distal end of the upper segment of the telescopic tube anchor themselves in what Killian has termed the "mouth of the œsophagus." If the spring is then pushed forward a few centimetres, the metal guides are separated and the œsophagus opened, the innermost of the six telescopic tubes passing the guides and exposing the œsophagus to the visual field.

2 *The passage of the œsophagoscope into the deeper parts of the œsophagus*

Although the anchoring of the instrument in the mouth of the œsophagus is performed blindly, this second stage of the process must only be undertaken under the guidance of the eye. The examiner seats himself on a chair in front of the patient and then pushes down the spring (Fig. 9), while watching the descent, as the patient swallows. It is essential that the lumen of the œsophagus is always kept in the field of vision. Usually this is easily accomplished. Should it vanish or become too excentric, it can be easily brought into view by gently lifting or dropping the handle of the instrument. When the examination is finished, the spring is gently pulled until the telescope is again closed (Figs. 10 and 11). The instrument is then withdrawn by dropping the handle and lifting the closed telescope out of the mouth.

The advantages of this right-angular telescope, as compared with the straight tube, are very marked. It is immaterial whether the patient has an easily movable cervical spine or a full set of teeth or not. The patient is not brought into any strained position, and the head is held in a natural way during the entire examination. The finding of the entrance of the œsophagus, which is often exceedingly difficult for the inexperienced beginner, occurs here blindly and automatically. The two metal guides act as an obturator or a sound, and lead the way for the instrument. The opening of the telescope is

so simple, because this instrument is the first that can really be pushed down in the longitudinal axis of the œsophagus and not at an angle to this axis. The ease with which the examination is possible was well demonstrated in Case IX. In looking for an incipient cancer of the œsophagus, I pushed the telescope down at least a half-dozen times, and thoroughly inspected the entire organ until I was certain that there were no pathological changes in the mucous membrane.

I trust that I shall not be misunderstood. Œsophagoscopy will always be, for the majority of patients, a rather disagreeable procedure. The introduction of even a soft stomach tube causes many patients to press and gag. Judging, however, from my experiences and those of many of my colleagues, who were present at my examinations, there is no comparison in the disagreeableness caused by the use of the new instrument to the extreme discomfort to the patient produced by straight-tube œsophagoscopy. I think I have succeeded in constructing a useful œsophagoscope, which answers those requirements that in the beginning of my paper I showed were demanded by such an instrument. To be sure, it has long since been proven that it is possible to inspect the œsophagus by means of a straight tube. That, however, this is the ideal method, which it has been claimed to be by many authors, and that it would not be worth while trying to improve upon this method, has never been my conviction. I think that the unpopularity of the straight-tube method proves that I am right.

I wish now to briefly consider another question. Is there really an actual demand for a useful œsophagoscope? Is there, for example, any necessity for the use of this instrument in the diagnosis of the most common affection of the œsophagus, *i.e.*, carcinoma? It has often been claimed that it is possible to make a certain diagnosis of œsophageal cancer merely from the clinical data without direct inspection. That may be true to a certain extent in the advanced cases with obstructive symptoms, and it is for this reason, namely, that the diagnosis can only be made when the disease has reached an advanced stage, that the attempted radical surgical treatment of this



disease has been so unsuccessful. The symptoms of this disease do not develop over night, and the symptoms of stenosis are merely the last link in the chain of clinical phenomena, which began often many months before. Frequently the patient will state that he was entirely well up to one or two weeks ago. If one goes into the history more carefully, however, one finds that the patient had burning pain in the chest, feelings of oppression, defective appetite, etc., all symptoms which usually began several months before. If we are to accomplish anything in the radical excision of oesophageal cancer, the only time to attack this disease by surgical measures is in the very earliest beginning. For this reason we do need an instrument that is not feared by physician and patient alike. The only possibility of making an early diagnosis of cancer of the oesophagus is offered by direct inspection with possibly a subsequent probatory excision. Even the X-ray is entirely ineffective in these incipient cases.

Oesophagoscopy is often of the greatest importance from the stand-point of differential diagnosis. As was shown in Case V, we were able to differentiate the dysphagic symptoms of a mediastinal tumor from a possible carcinoma of the oesophagus. In Case IX the clinical symptoms suggested a cancer of the oesophagus, but the negative oesophagoscopic findings removed this suspicion, and an exploratory laparotomy disclosed an extensive ulcer of the stomach.

I do not believe that the claim that the rarity of oesophageal affections does not warrant the expenditure of so much time and effort in the construction of a new instrument is tenable. I am convinced that oesophageal disease is by no means infrequent, and when our diagnostic methods have reached a greater state of perfection it will be seen that the lesions of the oesophagus are proportionately of common occurrence.

I would like here to answer an argument that might be advanced against the complexity in the construction of the instrument. There is no question that this new oesophagoscope is decidedly more complicated than the straight tube

that has been used hitherto. When one thoroughly understands the instrument, however, it works with as great a certainty as the straight tube, and if properly handled does not get out of order. I have examined several dozen cases with the same instrument, and it functionates just as well to-day as it did in the beginning. The instrument may be somewhat complicated, but at any rate its construction has been adapted to the patient and not *vice versa*. There is little doubt in my mind as to what choice the patient would make if both models were laid before him. It is immaterial to the patient whether the instrument is complicated or not. The important point is the possibility of a comfortable and certain examination.

A summary of my clinical results is herewith appended.

CASE I—J. P., male, sixty-two years (German Hospital, Dr. Kammerer). Three months ago pain in stomach. This left him, and two months ago he began to have pain low down in the throat and difficulty in swallowing, being able to swallow fluids only. Has lost about 10 pounds during past 6-8 weeks. Never expectorated blood. Never noticed blood in stools. Status negative, excepting œsophageal obstruction 10 inches from teeth.

March 6, 1912. Gastrostomy (Dr. Kammerer).

April 10, 1912. Œsophagoscopy ten inches from teeth the œsophagus lumen is obstructed by a cauliflower-like tumor, which occupies about two-thirds of the picture. The tumor's color is dark red, with some yellow spots on it. The other one-third of the lumen, *i. e.*, the part not occupied by the tumor, shows a silver-like color, very distinct from the dark red tumor (colored plate, Fig. 1).

*Diagnosis.* Proliferating carcinoma of the œsophagus, ten inches from teeth.

CASE II—R. M., male, forty-eight years (Mount Sinai Hospital, Dr. Brill). Previous history negative. Present illness since three months burning sensation in swallowing beneath sternum and increasing difficulty in swallowing. No vomiting, no regurgitation. Has lost in weight. Status large axillary glands. Many râles all over chest. Test meal nothing obtained, tube arrested at 11 inches, followed by some bleeding.

Œsophagoscopy May 1, 1912. Passage into the upper part of the œsophagus easily accomplished. The instrument passes down to 11 inches from the teeth, where it stops on account of obstruction. Œsophagus lumen at this point very narrow. No large proliferating tumor is seen, but a great number of grayish nodules, especially at the posterior wall of the œsophagus (colored plate, Figs 2 and 3).

*Diagnosis* Infiltrating carcinoma of the œsophagus at a distance of 11 inches from the teeth.

CASE III—S G, male, fifty-four years. (Mount Sinai Hospital.) Began six months ago with difficulty in swallowing solid food and sensation of pressure and fulness beneath sternum. Epigastric distress after meals. Four months ago discontinued swallowing all solid food on account of gradually increasing difficulty. Lost considerable weight and strength. Forced to vomit often after eating, owing to distress. No blood in vomitus. Stools negative. X-ray shows some dilatation of œsophagus. Bougie goes down to 18 inches (curling up in dilated œsophagus?).

Œsophagoscopy, May 10, 1912. The telescope is pushed all the way down into the œsophagus, but no pathological condition was seen. On the basis of these negatives I differed with the diagnosis made (carcinoma of the œsophagus) and said that we are dealing with a carcinoma of the stomach growing up toward the cardia. On the operating table (second service, Dr. Lilienthal, May 10, 1912) this was verified. A big tumor of the stomach was found, occupying the posterior wall of the stomach and part of the smaller and larger curvatures, going upward in the direction of the cardia, the cardiac end of the œsophagus being smooth and not infiltrated by the carcinoma.

CASE IV—S M, male, sixty-four years. (Mount Sinai Hospital Dispensary, Dr. Emil Mayer.) Eight weeks ago pain and burning sensation in swallowing. Can swallow fluids only. Loss of weight and strength. Bougie finds obstruction 6 inches from teeth. Œsophagoscopy May 22, 1912. After extending the telescope to its full length (cardia) a markedly congested area is seen on the left side, covered with whitish nodules, numbering about six. The œsophagus lumen, which was perfectly round in the upper parts of the œsophagus, appears here as a slit with protruding walls. A whitish mass is seen on the right side of the

In describing the telescope which is the essential novelty of this instrument, I wish to limit myself to the main points in its construction. It would be impossible to go into all the details of construction, as it would make the description too complicated. The telescope consists of six steel tubes the walls of which are 0.8 mm thick. At the upper and lower end of each tube is an attachment, of which the upper is shown in Fig. 6. The inner attachment protrudes into the lumen of the tube and forms a ridge, on which the next tube catches, when the telescope is open.

As can be seen in Fig. 6, the upper attachment of the tube is more than a simple ridge and is so constructed that a ring can be inserted into it. The rings serve the same purpose as the cylinder under the horizontal tube, namely, to keep the spring entirely out of the field of vision. They can be easily inserted into the upper part of each tube and just as easily removed with a small lever. On the outer part of each ring (Fig. 6) is a small plate and a button which fit into corresponding openings in the attachment to the tube and which keep the rings in place. On the posterior part of the ring (shown anteriorly in Fig. 6) is a groove which permits the spring to pass between the ring and the telescope.

Opposite this groove for the long spring is a small spring attached to three of the six rings. This small spring glides along the inner wall of the telescope when it is opened, and when the telescope is closed fits into a small groove in the ring just above and is thus buried. Although these little springs seem quite insignificant, they are of the greatest importance for the proper functioning of the telescope. The long spring (Fig. 5) has a tendency to produce a slight curvature of the telescope with the convexity toward the observer. That the telescope may work surely, especially for its withdrawal, it is essential that it is perfectly straight. This is the function of these short springs, namely, to counteract the tendency toward curvature produced by the long spring and to insure an absolutely straight telescope.

The distal end of the spring is soldered with silver to the upper edge of the lowest tube. At the lower end of the innermost tube is a metal ring which can be unscrewed and which opens the lumen of the œsophagus when the telescope is pushed down. This ring also facilitates the downward passage of the telescope. Attached to the lower part of the upper tube are two metal guides (Fig. 3). These guides are not only attached to this tube, but the tube and guides are made of one piece of metal. I shall later refer to the importance of these guides for the introduction of the œsophagoscope. These guides greatly facilitate the introduction of the instrument and since I have used them I have never had the slightest difficulty in introducing the œsophagoscope, with the exception of one instance, where pathological changes were responsible. The length of the telescope is now 33 cm. If one adds 10 to 12 cm as the distance from the posterior pharyngeal wall to the teeth, then the total distance from the teeth to the end of the instrument is 45 cm, which is quite sufficient to inspect the entire œsophagus down to the cardia. The diameter of the six tubes of the telescope varies from 12 mm (lowest tube) to 17 mm (uppermost tube). It would be easily possible to add another tube

CASE VII—A K, male (German Hospital, Dr. Willy Meyer) Since one year pain and difficulty in swallowing, during the past three months nothing but fluids passed. Bougie blocked at 16 inches.

Oesophagoscopy June 22, 1912. Cocamization of pharynx. Easy introduction of instrument. The telescope pushed down to about one and one-half inches above cardia, where an obstruction of the lumen is present. The small but clear field of vision shows two very distinctly different aspects of the mucous membrane of the oesophagus. The lower part (anterior wall) is whitish in color (normal oesophageal mucosa), whereas the upper part (posterior wall) shows a dark-red coloration with numerous very small nodules on the surface. The appearance of the area resembles very much the irregular surface of a strawberry (C p, Fig 5).

*Diagnosis* Carcinoma of the cardia.

*Operation* (June 24, 1912) (Dr. Willy Meyer).—Extensive involvement of cardiac end of stomach by carcinomatous growth. Gastrostomy.

CASE VIII—F C, male, sixty-seven years (German Hospital, Dr. Willy Meyer) Since ten weeks feels that food sticks in his throat. Vomited some mucus, no food. Never any blood. Loss of weight 20 pounds. Bougies can only be passed 20 cm down from teeth.

Gastrostomy June 10, 1912.

Oesophagoscopy June 25, 1912. Cocamization of pharynx. The telescope can be pushed down to a distance of 10 cm above the cardia. At this point the opening is seen as a small slot. At the left side of this slot the normal oesophageal mucosa appears of whitish color and markedly corrugated. The right side of the slot, which is situated somewhat eccentrically, is very much indurated, and shows a few prominent grayish nodules adorning the border of the oesophagus lumen. More laterally the oesophagus mucous membrane is markedly congested, quite different in appearance from the left side (C p, Fig 6).

*Diagnosis* Carcinoma of the oesophagus behind the aortic arch. The patient stood the examination extremely well, so that the instrument could be left in place for twenty minutes (in order to show the picture to a number of colleagues) without causing any discomfort.

CASE IX—G S, sixty-five years (German Hospital, Dr Willy Meyer) Two months ago began to have sensation at lower end of sternum as if his food stuck This gradually got worse Has never vomited, but feels nauseated

The bougie found some obstruction 8 inches from teeth, but after passing this distance could be pushed all the way down into the stomach Œsophagoscopy June 29, 1912 Telescope pushed down under guidance of eye without encountering any obstruction Mucosa appears perfectly normal on repeated inspection by moving the end of the instrument up and down the whole length of the œsophagus

Epicrisis Based on the œsophagoscopic inspection, the suspicion of a beginning carcinoma behind the cricoid could not be entertained We then came to the conclusion that he was suffering from a gastric and not from an œsophageal disease

Laparotomy (Dr Willy Meyer, June 28, 1912) showed a circular ulcer of the stomach (hour-glass stomach), not involving the cardia

Gastro-gastrostomy was done

CASE X—S B, female, fifty-four years (Mount Sinai Hospital) Substernal pain for the last nine months after ingestion of food Feeling of obstruction Vomited for four months right after taking food, occasionally bloody Lost about 30 pounds in weight Obstruction found 10½ inches from teeth Tumor bleeds very easily Œsophagoscopy July 11, 1912 The upper part of the œsophagus shows a normal mucous membrane and long horizontal slit (C p, Fig 7) In pushing down the tube to 10 inches, the opening appears very narrow, the whole surrounding mucosa shows a dark-red coloration Around the lumen, which is of very irregular outlines, nodular masses are seen, which protrude into the œsophagus lumen (C p, Fig 8).

*Diagnosis* Carcinoma of the œsophagus 10 inches from teeth  
*Gastrostomy*

Before concluding my paper, I desire to say a few words in regard to the experiments I have made in attempting to apply the telescopic principle to a gastroscope These experiments extended over a period of two years, but were abandoned during my experimentation with the œsophagoscope The optical part of this gastroscope is turned in the stomach by

means of a bevel-gearing, applied to the proximal end of the connection by Eckstein. With this arrangement I have been able to inspect the wall of the trachea in a few cases, but, not having had any tangible clinical results, I prefer to postpone a detailed description of the apparatus to a later time.

In conclusion I wish to thank Dr. Hermann Witten and Dr. Sidney Yankauer for their assistance in the construction of my instrument-maker, Mr. Brown, for his painstaking efforts during the construction of the instrument.

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# INTRATRACHEAL INSUFFLATION ANÆSTHESIA \*

CONSIDERED FROM ITS PHYSIOLOGICAL AND CLINICAL ASPECTS

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THE problem of artificial respiration—that is, the maintenance of a sufficient supply of fresh air to the alveoli—consists clinically of two separate and distinct processes, one or both of which may devolve upon the physician

I The maintenance of an unobstructed passage-way for both the afferent and the efferent air current

II The maintenance of a sufficient volume flow of air through such passage-way as may be needed (*a*) to supply the requisite amount of oxygen, and (*b*) to remove the excreted CO<sub>2</sub>

The method of intratracheal insufflation aeration, without the necessity of respiratory movements, as recently described by Meltzer and Auer,<sup>50</sup> while ideally simple, fulfils both these conditions and is therefore of great clinical value, this is especially true from the surgical stand-point, as the method likewise permits of the easy administration of the anæsthetic and is particularly applicable to operations within the thorax and those about the head, neck and mouth

In order to form a correct opinion as to the merit of intratracheal insufflation anæsthesia, and above all to employ the method successfully, it is imperative that one should have the knowledge of the physiological facts on which the method

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\* Amplification of paper read by the Junior Author to the Obstetrical Society of Boston, November 28, 1911



means of a bevel-gearing, applied for the first time in this connection by Eckstein. With this instrument I have been able to inspect the wall of the stomach in a few cases, but, not having had any tangible clinical results as yet, I prefer to postpone a detailed description of the instrument to some later date.

In conclusion I wish to thank Dr. Heinrich Wolf and Dr. Sidney Yankauer for their many invaluable suggestions and my instrument-maker, Mr. Braunesleuther, for his painstaking efforts during the construction of my instruments.

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Bellows, and permitting the Lungs to subside and lye still, and of suddenly reviving him again by renewing the blast, and consequently the motion of the Lungs This, I say, having been done, and the Judicious Spectators fully satisfied of the reality of the former Experiment, I caused another pair of Bellows, to be immediately joined to the first by a contrivance I had prepar'd, and pricking all the outer coat of the Lungs with the slender point of a short penknife, this second pair of Bellows was mov'd very quick, whereby the first pair was always kept full and always blowing into the Lungs, by which means the Lungs were always kept very full, and without any motion, there being a continual blast of Air forc'd into the Lungs by the first pair of Bellows, supplying it as fast as it could find its way through the coat of the Lung by the small holes pricked in it, as was said before

"This being continued for a pretty while, the Dog, as I expected, lay still, as before, his eyes being all the time very quick, and his Heart beating very regularly But, upon ceasing this blast and suffering the Lungs to fall and lye still, the Dog would immediately fall into dying convulsive fits, but he as soon reviv'd again by the renewing the fulness of his Lungs with the constant blast of fresh Air

"Toward the latter end of the Experiment a piece of the Lungs was cut quite off, where 'twas observable, that the Blood did freely circulate, and pass thorow the Lungs, not only when the Lungs were kept thus constantly extended, but also when suffered to subside and lye still Which seem to be arguments, that as the *base* Motion of the Lungs *without fresh Air* contributes nothing to the Life of the Animal, he being found to survive as well when they were not mov'd, as when they were, so it was not the subsiding or movelessness of the Lungs that was the immediate cause of Death, or the stopping of the Circulation of the Blood through the Lungs, but the want of a sufficient *supply of fresh Air.*"

It is idle to attempt to determine who first applied Hook's use of the bellows (introduced into the mouth) to the human being in an endeavor to revive those suffocated by drowning or other causes The monographs of Goodwyn<sup>3</sup> (1788), Fothergill<sup>4</sup> (1795), and others show that in the latter part of the eighteenth century the bellows were in general use and were recommended by the Royal Humane Society for restoring drowned people, at this time also overdistention of the lungs was well recognized, likewise the danger of blowing up the stomach, when the larynx was obstructed by the tongue and epiglottis, was appreciated An attempt to avert the first danger was the adoption of the various forms of graduated piston pumps, to avoid the second, traction on the tongue

is based, as well as the attempts previously made to develop an acceptable technic of artificial respiration devoid of intrinsic danger. Accordingly, an extensive review of the subject seems justified.

Andreas Vesalius,<sup>1</sup> the founder of modern anatomy, discovered that he could prolong the life of an animal after opening its thorax to study the motions of the heart, by blowing through a tube introduced into the trachea. Although Vesalius thus, as early as 1560, in a way, prolonged life by performing artificial respiration with the thorax open, yet we are indebted to Robert Hook,<sup>2</sup> who lived in the latter part of the seventeenth century, for demonstrating that the respiratory movements were simply for the purpose of bringing about a supply of fresh air to the lungs.

The original account of Hook's fundamental experiment of respiration is so pertinent to our immediate problem that I will quote from his article<sup>2</sup> delivered before the Royal Philosophical Society on October 29, 1667

"I did, heretofore, give this *Illustrious Society* an account of an experiment I formerly tryed of keeping a Dog alive after his *Thorax* was all display'd, by the cutting away of the Ribs and Diaphragme, and after the *Pericardium* of the heart also was taken off. But divers persons seeming to doubt of the certainty of the Experiment (by reason that some Tryals of this matter, made by some other hands, failed of success), I caused, at the last Meeting, the same Experiment to be shewn in the presence of this *Noble Company* and met with the same success, as it had been made by me at first, the Dog being kept alive by the Reciprocal blowing up of his lungs with the *Bellores*, and they suffered to subside, for the space of an hour or more, after his *Thorax* had been so display'd, and his *Aspera arteria* cut off just below the *Epiglottis*, and bound on upon the nose of the *Bellores*.

"And because some Eminent Physicians had affirm'd, that the *Motion of the Lungs* was necessary to Life upon the account of promoting the Circulation of the Blood, and that it was conceiv'd the Animal would immediately be suffocated as soon as the Lungs should cease to be moved, I did (the better to fortifie my own *Hypothesis* of the matter, and to be the better able to Judge of several others) make the following additional Experiment

"Viz The Dog having been kept alive (as I have now mentioned) for about an hour, in which time the Tryal hath often been repeated, in suffering the Dog to fall into *Convulsive* motions by ceasing to blow the

dition, and intubation failed to establish itself. In 1871 Weinlechner,<sup>23</sup> apparently without knowing of Bouchut's suggestion, proposed catheterization of the larynx in croup, again the idea did not meet with a favorable reception. O'Dwyer,<sup>24</sup> of New York, in 1885 described an exceedingly practical tube and introducer that became at once popular, and which has with a few modifications remained the generally accepted tube for use in diphtheria.

In 1887 Fell<sup>25</sup> of Albany saved a severe case of opium poisoning by the use of his laboratory respiration apparatus, consisting of a bellows and tracheotomy tube. Against the opposition of his colleagues he popularized his method as "forced respiration" and claimed it as a wonderful discovery, we have seen above how similar procedures had been used as early as the latter part of the preceding century and that they had been eventually discarded on account of their intrinsic dangers. In 1894 Northrup<sup>26</sup> combined the "forced respiration" as described by Fell with the laryngeal tube of O'Dwyer. This Fell-O'Dwyer method was taken up by Matas<sup>27</sup> and used in intrathoracic work shortly afterward, and its advantages set forth by him in a masterly monograph in 1900.

Likewise Maydl<sup>28</sup> and Eisenmenger,<sup>29</sup> both of Vienna, published in 1893 descriptions of tubes modified from that of O'Dwyer, to which they connected rubber tubing, on the end of which was attached a funnel for administering ether after the style of the apparatus used by Trendelenburg<sup>30</sup> for administering the anæsthetic through a tracheotomy wound, they used it for extensive operations about the mouth, for by this means they could pack the larynx and prevent entrance of blood into the trachea and lungs, the patient, of course, had to respire voluntarily.

Kuhn,<sup>31</sup> of Germany, has done more than anyone else during the last 15 years in attempting to develop and popularize a laryngeal tube that would be practical and useful in surgical work about the head, neck, and mouth, as well as lately within the thorax. His earlier apparatus, like that of Maydl and Eisenmenger, consisted of a modified O'Dwyer tube to which he attached, by rubber tubing, a funnel. This, of course, increased his "dead space," to avoid which he later used a two-way tube to allow easy exit to the air. Finally, in 1908, he<sup>47</sup> adopted a method which came very near being perfect, through a large laryngeal tube he introduced a smaller tube which conducted a steady stream of air into the upper part of the trachea under a constant pressure, the return flow escaped through the space between the inner and outer tubes, the resistance of which created a sufficient pressure for intrathoracic work. Such an apparatus was simple, uncomplicated by valves, and quite efficient, Kuhn's method, however, failed to do away with the dead space between the larynx and the bifurcation of the trachea and so was dependent on respiratory movements to bring about a sufficient exchange of air, and it is in this essential point that it differs from Meltzer and Auer's perfected method. In short, Kuhn never appreciated either the desirability, or the practicability of respiration without the necessity of respiratory movements.

The probable great value of some form of static differential pressure

was recommended, and if this failed tracheotomy was advised

The use of intubation for keeping the air-passage unobstructed dates from the day in the latter part of the eighteenth century when Desault<sup>5</sup> accidentally entered the trachea while attempting to perform œsophageal feeding, and found to his surprise that the larynx tolerated the tube for an extended time. As a result, Desault devised the technic of introducing a rubber catheter, carried by a curved probe, into the trachea for the purpose of relieving embarrassed respiration due to stricture of the larynx.

Chaussier,<sup>6</sup> the French obstetrician, in 1805 combined positive ventilation (preferably by mouth) with a metal tube of proper curve and length to enter the larynx for the purpose of initiating respiration in infants which were born in a state of apparent death. The tube of Chaussier met with considerable favor and was variously modified by Dozes<sup>7</sup> and others so as to be available for use with the bellows in restoring those suffocated by drowning or other causes.

The potential power of producing harm by the general use of the bellows in the hands of the untrained led LeRoy<sup>8</sup> in 1827 to make a study of the problem directly from this view-point. LeRoy<sup>8</sup> presented his conclusions in a memoir to the Academy of Science (Paris) in which he showed that emphysema and even death could readily be caused by a too vigorous use of the bellows by the inexperienced. Therefore he recommended a method of respiration by compression of the chest and abdomen, he, however, approved of the maintenance of a free air-passage by means of a tube introduced into the trachea, and accordingly described an instrument designed to aid the introduction of a soft rubber catheter. Magendie,<sup>10</sup> representing a committee appointed by the Academy of Science to investigate LeRoy's assertions, reported in the affirmative as to the dangers of positive pulmonary ventilation, accordingly the use of the bellows was practically abandoned and along with it the tracheal tube.

Depaul<sup>11</sup> in 1845 made an attempt, only partially successful, to again popularize the tube of Chaussier<sup>6</sup> in the treatment of the drowned and especially in initiating respiration in the new-born. This method, however, fell into final disuse as a result of the efficient and safe method of artificial respiration proposed by Marshall Hall<sup>12</sup> in 1856. Aside from producing contraction of the chest by pressure (with passive expansion) as suggested by LeRoy,<sup>8</sup> Hall's essential point consisted in maintaining a free air-passage by adopting the prone position, which allowed the tongue and epiglottis to fall forward and therefore out of the way of their own accord.

Bouchut<sup>13</sup> in 1857-8 clearly and accurately described tubage of the larynx for croup, strong opposition was at once aroused by Trouseau and his followers, who had lately popularized tracheotomy for this con-

such as Meltzer and Auer have described, which when properly conducted renders death from cessation of respiration impossible, whether the thorax be open or closed, has created a tremendous interest in the surgical world

The first investigator, since the time of Hook in the 17th century, to consider the question of artificial respiration without the necessity of respiratory movements, excepting Nagel<sup>54</sup> working on birds, was Volhard<sup>46</sup> The latter in 1905, through his pupil Hans Hirsch,<sup>41</sup> published a series of experiments By the use of a small stream of oxygen introduced a short distance into the trachea, they succeeded in maintaining the animal alive for a period of about two hours, when death would occur from an accumulation of  $\text{CO}_2$ , if air was used, the animals would die much quicker The failure of the method was due to the smallness of the oxygen or air stream, which, though sufficient to maintain oxygenation, was not of such volume and pressure as to maintain the lungs in a state of distention, whereby diffusion and the removal of the secreted  $\text{CO}_2$  could take place

Robinson<sup>48</sup> in 1908 repeated the Volhard experiment through a tracheotomy wound, he came somewhat nearer to the goal in that he used a current of air which maintained the lungs in a state of at least partial expansion, he also recognized the necessity of reducing the dead space for  $\text{CO}_2$  retention, though he failed to specifically direct that the tube should be introduced to the tracheal bifurcation

Let us now briefly enumerate the advantages of the method of Meltzer and Auer<sup>50, 52</sup> as clinically used

By means of a soft rubber catheter the air with its requisite amount of ether is carried directly to the bifurcation of the trachea, from this point there is a constant return stream between the catheter and the wall of the trachea to the free air The size of the catheter should be about a No 23 F; its exact size in comparison with the trachea is immaterial within considerably wide limits, and we have found this one size to be suitable for all adults The escape of the air from the end of the catheter and its return through the trachea create air currents in the bronchi which greatly aid diffusion Therefore it is very easy to supply the patient with as much oxygen as he needs, and also to remove all the  $\text{CO}_2$  excreted. If the thorax is opened, the resistance to the outflow is sufficient to maintain the lungs in moderate expansion; complete expansion is not only unnecessary but it is undesirable from

for intrathoracic operations led to considerable experimental activity along this line in the laboratory of Francois Frank, and as a result we find two forms of positive pressure apparatuses emanating from this laboratory as early as 1896 Tuffier and Hallion<sup>31</sup> proposed a method whereby the disadvantages and dangers of pumping air in and out of the lungs were avoided by connecting with a pressure reservoir a tube introduced through the mouth and made to fit the trachea tightly by a specially designed clamp, by suitable valves the expiration was opposed by a water valve of 20 cm pressure, thus keeping the lungs distended. The exchange of air, however, had to be entirely maintained by the natural respiratory movements of the animal against this pressure. Quénu and Longuet<sup>32</sup> arrived at the same result by using a head-piece or mask, like a diver's helmet, in which positive pressure was maintained and which proved to be the forerunner of the later improved positive pressure cabinets.

In 1904, Sauerbruch,<sup>33</sup> at the instance of Mikulicz,<sup>33</sup> made a most comprehensive study of the question of surgical pneumothorax. His monograph stands as the basis of all recent work on the subject, in this Sauerbruch followed up the suggestion made by Woillez<sup>34</sup> in 1875 as to the advantages of negative as opposed to positive pressure, and enlarged the latter's "Spirophore," first to a small cabinet just large enough for animal work, and then into his now famous negative pressure operating room with its complicated accessories. The evident excellence of this piece of work, backed by the prestige of Mikulicz, brought about the general acceptance of Sauerbruch's conclusions in regard to the advantages of negative as opposed to positive pressure, notwithstanding the fact that Brauer<sup>37, 38</sup> and many others soon demonstrated that physiologically there is no difference between the two methods, and that from the practical stand-point the positive pressure apparatus is preferable. All are, in a general way, familiar with the various differential pressure apparatuses as devised by Sauerbruch, Brauer, Tiegel,<sup>40</sup> Meyer,<sup>44</sup> Robinson,<sup>43</sup> and many others, by means of which great advance has recently been made in thoracic surgery, accordingly we will not consider the details of the various modifications.

However, all these differential pressure apparatuses, whether negative or positive or even combined, are designed to render possible *spontaneous respiration* under conditions of surgical pneumothorax, they do not provide any efficient and practical means of aiding respiration, whenever for any cause such spontaneous respiration ceases. Further, it is practically impossible, or at least very difficult, in the case of an anæsthetic accident for the administrator to render material assistance on account of the mechanical interference of the apparatus. In consequence it is no wonder that a method,

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the surgeon's stand-point If, for any reason, the patient should appear under-aerated, it is a simple matter to interrupt the current for a few seconds and allow the lungs to subside and completely empty themselves, as suggested by Meltzer and Auer in their more recent articles This, however, is only occasionally necessary, as will be more fully pointed out later On closing the thorax, gentle pressure on the trachea increases the resistance to the outflow, so that the lungs may be made to completely expand and obviate post-operative pneumothorax If you have removed a whole or a half lung, do not expect that the remainder can safely be made to fill the thorax immediately

It is perfectly possible to maintain efficient aeration by this method indefinitely, as Meltzer and Auer's experiments on curarized animals show We have kept a cat anæsthetized 16 hours by gas and oxygen administered intratracheally with both pleural cavities widely opened, on the discontinuance of the anæsthetic the animal recovered within 15 minutes, though in a state of exhaustion from its all-night exposure in a cold room

The question of providing a free return of the air through the larynx and mouth must be seriously considered In the first place, the tongue is apt to drop back and offer just sufficient resistance to direct some of the air down the œsophagus into the stomach This is quite a common occurrence, and may easily be avoided by holding the tongue forward by either forceps or a stitch

A more serious question is that of *spasm of the glottis*, in which the vocal cords shut down more or less tightly around the catheter

This spasm of the glottis only occurs when the patient is light and the administration of ether soon brings about relaxation of the cords Personally I have never seen the cords grasp the catheter so tightly as to obstruct all reflux of air, and believe its occurrence highly improbable If complete closure should occur it would of course be impossible to administer the anæsthetic to bring about relaxation, there-

fore Meltzer and Auer's method of interrupting the air current and allowing the lungs to subside should be intermittently practised until the addition of ether brings about relaxation, when the necessity of this procedure will be found to have ceased. A two-way tube, such as that recommended by Kuhn, we do not like, as it lacks the advantage of blowing out the mucus from the trachea, in oral surgery the prevention of the inhalation of blood is a distinct factor in the preference for a one-way tube.

That spasm of the glottis with partial obstruction to the return flow for a few minutes is common there is no doubt. In consequence, at the very first a mercury safety-valve <sup>k</sup> of 15 mm pressure was introduced by us into the air current of the apparatus we used, this factor of safety is likewise incorporated into Ehrenfried's <sup>75</sup> apparatus. Such a safety-valve effectively prevents any danger of excessive distention of the lungs with resulting emphysema or even death. In a very extensive use of the method in all kinds of abdominal and thoracic work on animals, and a moderate clinical experience, the only death or suggestion of trouble we have seen was due to acute distention of the lungs in a cat by a high pressure. The accident occurred because we had removed from our laboratory apparatus the mercury safety-valve for use in clinical work, after introducing the tube and while washing our hands, and as usual paying no attention to the animal, spasm of the glottis occurred which resulted in death, probably within 15 seconds, as we were using the high pressure supplied by the school. Had the safety-valve been in use when the spasm of the glottis occurred, we should have heard it bubbling, the addition of ether to the air would immediately have overcome the spasm and the animal would have been in no danger.

We are inclined to think that most of the trouble of Meltzer and Auer, as well as others, in obtaining a tube suitable for

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\* We have repeatedly called attention <sup>87</sup> to the necessity of a safety-valve, in spite of this accidents are still occurring from failure to have an efficient one on the apparatus.

the case is due to partial spasm of the glottis. Our reasons for this belief are that we always use the same tube for all sized cats and always a No 23 F soft rubber catheter in our clinical cases (adults), without the suggestion of any trouble other than that noted of temporary partial closure of the glottis. Further, this phenomenon can be readily studied in the cat, with the head extended the cords can be seen partially open, on attempting to introduce the tube when the animal is "light" the irritation of the tube in the pharynx and against the epiglottis causes the glottis to close, therefore in order to introduce the tube the anæsthesia must be pushed to such a depth that the pharyngeal and laryngeal reflexes are overcome—then the cords are seen to be widely open, and they do not contract on introduction of the catheter. After the introduction there is always a free return of air for several minutes or until the cat becomes "light," then the cords can be seen to close around the catheter, the mercury safety-valve bubbles, the tongue and nose become gradually cyanotic, and the animal appears to enter a dangerous state. At first we did not know exactly what to do, experience in a large number of animals has proved that the administration of ether (strong, the current bubbling through the ether) quickly deepens the anæsthesia sufficiently to overcome the reflex spasm, reflux of air takes place and the animal is again "safe."

In one of their earlier papers, Meltzer<sup>55</sup> and Auer make the statement that an animal cannot be given too much ether by their method, and attempt to explain the fact as an intrinsic virtue of intratracheal insufflation. That they with their apparatus were not able to excessively etherize their animals we do not doubt, their attempted explanation, however, is all wrong, and the error should be strongly brought out. (This they have recently done.) The question of ether dosage is merely the one of proportional arrangement between the volume of the air current and the size of the ether bottle, together with the particular arrangement of the tubes within the bottle. It is easy to arrange the ether bottles and tubes

so that the air in passing through the bottle may take up such a large percentage of ether that the animal dies within five minutes from ether poisoning

Ehrenfried has adopted in his simple intratracheal apparatus what we have in our gas-oxygen apparatus, namely, an arrangement of tubes and valves so that the air and gases may be passed partly or entirely over the surface of ether or made to bubble through the ether

We consider it essential for an apparatus for anæsthesia by the vapor method, whether or not intratracheal, that it be possible to give a large percentage of ether for a short period or until the patient is relaxed, as soon as relaxation occurs, and this is possible in every case, including alcoholics, the strength of the ether vapor is decreased or it is entirely discontinued as may be indicated. It goes without saying that liquid ether should not be blown into the bronchi, with positive prevention of this any apparatus is simplicity itself (three inches of glass tubing lightly packed with cotton or gauze inserted into the current). On the other hand we have seen no satisfactory evidence produced that ether vapor, whether or not produced by bubbling a stream of air at room temperature through the ether or by passing it over the surface, causes injury of the lungs provided it be administered in doses suitable for anæsthetic purposes. A very extensive series of major operations on cats (blood-vessels), in which we used the bubble principle exclusively, as it allows us to properly conduct the anæsthesia by stepping on the by-pass tube with our foot, has failed to show any injury to the lungs that can be perceived clinically. There is one point, however, against which we wish to caution in regard to the use of ether vapor methods in which the apparatus is warmed and that is the danger of using too much heat so that pure ether vapor is boiled over, remember that ether boils at a temperature below the body ( $96.5^{\circ}$  F). Also remember that the excessive cold produced by the evaporation of any liquid occurs at the point where the liquid is converted into a gas, therefore after the change has taken place, on account of the

light weight and actual small substance of a gas, the latter acquires the temperature of its surrounding body without adding or subtracting materially from the temperature of that body (referring to volumes such as would be used for anæsthetic purposes) In other words air at room temperature bubbling through ether is again at the same temperature after passing through three feet of rubber tubing

Using a small bottle and passing the air over the surface of the ether lowers the temperature of the air in the bottle to such a point that the percentage of ether taken up by the air is below that which produces an anæsthesia of sufficient depth to abolish laryngeal and pharyngeal reflexes This difficulty can be overcome (*a*) by immersing the small bottle in hot water or other heating device, (*b*) by using a large bottle, thus giving large evaporating surface and therefore capable of being kept warm by the room temperature

We believe that the air and ether vapor should be delivered to the patient at least within a few degrees of the room temperature, as this is obtained by the use of a large ether chamber and three feet of tubing we do not believe in complicating the apparatus with a heating device If, however, only a small ether chamber is available, it must be heated in order to get a sufficiently high percentage of ether vapor We cannot agree with Gwathmey's contention that air and ether vapor *superheated* above the room temperature usually respired is of benefit

Some anæsthetists make it a practice to combine chloroform vapor with ether either together or in sequence These combinations are based on the supposed inability to relax the patient by ether vapor, there is no foundation for this supposition, provided the ether bottle is of sufficient size and the tubes are properly arranged Some two or three decades ago there occurred many deaths in England from the use of chloroform by the closed or vapor method, let us not repeat this sad history by producing a similar series of deaths from the same cause in this country In contrast to the known great danger of the closed method of chloroform

anæsthesia, the theoretical supposition of lung injury from ether administered by the vapor method of sufficient strength to properly anæsthetize the patient, as opposed to a sufficient amount given by the cone, is too far fetched to be seriously considered by those acquainted with all the available facts. In short we wish to most strongly advise against any such use of chloroform in connection with the intratracheal method.

Instead of ether being carried by an air current as the anæsthetic agent by intratracheal insufflation method, we recently reported the use of nitrous oxide-oxygen-ether as the anæsthetic. A moderate though not extensive use of this latter combination both in humans and in animals still leaves us undecided as to its desirability. We hope shortly to have a series of cases of sufficient length to justify an opinion on the subject.

If it is desired to use nitrous oxide-oxygen as the carrier of the ether vapor, our apparatus<sup>88</sup> is capable of efficiently and safely doing this. By means of a Y connection the mercury safety-valve is attached. To take care of the irregularity in the outflow caused by the respiration of the patient and to supply the extra quantity of gas-oxygen needed on inspiration, thus obviating the sucking in of air around the tracheal tube, a small rubber bag is inserted near the patient.

The question of the  $\text{CO}_2$  content of the blood is one of great importance. Haldane and his co-workers in England have shown that the normal respiratory movements are governed by the percentage of  $\text{CO}_2$  in the blood, they have further shown that excessive respiration quickly reduces the total amount of  $\text{CO}_2$  in the body, resulting in a condition of apnoea, lasting until the  $\text{CO}_2$  is reaccumulated. Henderson<sup>80</sup> has recently advanced the hypothesis that a material decrease from the normal total quantity of  $\text{CO}_2$  in the body, by its effect on the circulation, is as dangerous to life as an increase. The symptoms of an abnormal decrease in the  $\text{CO}_2$  content of the body in regard to respiration, if uncomplicated by other stimulating factors, is a condition of apnoea, if hyperpnoea is in any way maintained by artificial respiration.

or by strong stimulation of the respiratory centre by pain, the increasing reduction of the  $\text{CO}_2$  content shows its harmful effect on the circulation by bringing about a progression of symptoms ending in a picture clinically similar to that commonly known as shock. It is very reasonable to suppose that a material decrease in one of the normal constituents of the body is as harmful as its increase, in consequence, the theory of acapnia and its relationship to shock deserves an extensive clinical investigation to see whether or not it agrees with the findings of the physiological laboratory.

In a brief series of cases we found, at least in certain cases, that there is clinically a relationship between acapnia and shock. These cases will be shortly published,<sup>90</sup> and it is our hope that some means will be found adaptable to clinical use for the determination of the  $\text{CO}_2$  content of the blood, whether or not we will be able to obtain alveolar air for this purpose is questionable, though that at the present time it seems the more practicable method.

In a recent article Henderson states the question of  $\text{CO}_2$  relationship in regard to the ordinary administration of ether very clearly. We wish to call attention to a few points in regard to  $\text{CO}_2$  elimination by the intratracheal method. By this method increased respiratory movements or attempts at movements will be increased whenever there is an inefficient removal of the excreted  $\text{CO}_2$ , the remedy is to increase the volume of the stream (not the pressure). If the  $\text{CO}_2$  is at the normal point, the patient will make what appear ordinary light respiratory motions. On the other hand, as soon as one produces excessive aeration and  $\text{CO}_2$  removal, one will produce first a condition of apnoea, which if prolonged will result in the picture of shock, when the apnoeic condition develops, one must decrease the volume of air or of nitrous oxide and oxygen and allow a reaccumulation of  $\text{CO}_2$  in the body. The aim of the anaesthetist is to maintain the  $\text{CO}_2$  content of the blood as near normal as possible, therefore, one should take care to maintain one's volume of air or combined gases so that the patient breathes or rather attempts

to respire in a practical normal manner. In anæsthetic accidents in which apnoea develops as a result of acapnia by the cone method of anæsthesia, it is sometimes difficult to restore respiration before the patient dies of anoxæmia. By the intratracheal method such death from anoxæmia due to lack of respiration is impossible, and with only moderate care not more than a mild condition of acapnic shock is possible, and even this can be avoided by maintaining the patient in such a state that spontaneous respiratory movements occur, though they may be safely reduced both in frequency and depth.

The introduction of the catheter into the trachea when the patient is deeply anæsthetized is comparatively easy by means of the instrument perfected by us,<sup>83</sup> provided that the anatomy of the oropharynx and of the larynx is understood. With the patient deeply anæsthetized, the introduction is as follows. Arrange the head so that it is slightly extended, this procedure puts the larynx and trachea on the stretch and the lumen is maintained by the rigidity of the cartilages of the larynx while the œsophagus is pushed back, the pressure tending to keep the latter opening closed. Pull the tongue moderately forward, introduce the finger till it passes over the tip of the epiglottis, insert the introducer with the catheter projecting one-third of an inch, over the back of the finger, along down, hugging tightly the posterior surface of the epiglottis, keeping always in the median line, till the handle of the instrument is at right angles to the body (not at right angles to the mouth if the head is more than slightly extended), then feed the catheter and it will slide directly into the trachea.

However, there is one mistake in attempting to introduce the tube that nearly every beginner makes—that is, depressing the handle of the instrument too far or in other words carrying it beyond a right angle to the body. This mistake directs the catheter against the anterior wall of the larynx at the base of the epiglottis between the thyroid cartilage and the hyoid bone. This space as seen on the median section is merely covered over by the thyrohyoid membrane or



which are two very thin muscles. In short, pressure here readily develops a pocket into which the tip of the catheter slides and this prevents its further progress. An assistant can materially aid the introduction by gently exerting counter-pressure over the thyrohyoid membrane and the thyroid cartilage.

Personally we have never seen any injury to the larynx by the tube and believe it is unnecessary. To be sure, when learning how, we occasionally slightly injure a urethra in passing a sound, but that is overcome by practice. We believe the same will be found to be true of catheterization of the trachea. If possible, preliminary practice should be made on the cadaver, at least the anatomy of the parts should be well understood. We have heard of one or two cases of aphonia lasting two or three days after a troublesome introduction, but nothing more serious.

The following conclusions we feel are justified

- 1 Intratracheal insufflation respiration is the only artificial method that absolutely provides for a sufficient aeration of the lungs, regardless of the respiratory movements of the patient, and that properly administered and safe-guarded can be rendered devoid of intrinsic danger

- 2 In consequence, anæsthesia by this method is indicated whenever the operation is about to interfere in any way with the ability of the patient to voluntarily respire

- 3 Therefore it ought to be used in all intrathoracic work and in extensive operations about the head, neck, and mouth

- 4 Of the various anæsthetics to be used with this method, ether with air, preferably supplied by a foot pump,\* is the most applicable for general use, however, nitrous oxide-

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\* At the new Brigham Hospital the operating rooms are provided with compressed air from the central power plant, we are going to use Connell's meter and percentage ether apparatus by which the quantity of air administered and the actual amount of ether used are determined with nearly absolute accuracy, it is a wonderful piece of apparatus and will be of immense benefit for teaching purposes (paper about to be published). For those hospitals that desire an efficient, simple, and inexpensive apparatus, that designed by Dr F L Richardson of Boston is by far the best (paper about to be published)

oxygen with minimal quantities of ether may occasionally be the anæsthetic of choice.

5 To prevent deaths from emphysema, no matter what form of apparatus is used the same must be provided with a *safety-valve* by means of which the intrathoracic pressure cannot exceed 15 mm mercury

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# THE ANÆSTHETIC EFFECTS OF THE INTRAVENOUS INJECTION OF PARALDEHYDE.

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It has long been recognized that paraldehyde is in many ways the most perfect hypnotic we possess. In certainty of action it is unsurpassed, while its stimulating effect upon respiration and circulation and its absence of after-effects are in marked contrast to the depression, immediate and remote, produced by other hypnotics. Given by mouth, its taste is a serious disadvantage, and the preliminary excitement it may sometimes cause is undesirable.

It appeared to us that these defects could be largely overcome by intravenous injection, and the results of our experiments have exceeded our expectations. The hypnotic effect is the most perfect we have ever seen, being exceedingly rapid and yet devoid altogether of unsatisfactory circumstances. The patient appears both to himself and to onlookers to pass into a perfectly natural and easy sleep. Respiration deepens, the pulse is slower and fuller, the color is absolutely unaltered. Yet if the injection be continued deep anæsthesia can be produced with great rapidity. This latter fact opens up a wide field upon which we hope shortly to make a further communication. Here we shall restrict ourselves to the use of paraldehyde intravenously as a hypnotic or as an anæsthetic for minor operations.

Paraldehyde is a colorless, volatile liquid with a characteristic and unpleasant taste and smell. Its sp gr is 998, it is soluble in 10 volumes of water at 15° C, less soluble in hot water, and boils at 124° C. It is miscible in all proportions.

with ether and alcohol. Under ordinary circumstances it has no depressing effect upon the heart. Intravenously we found it to act momentarily as a depressant. This effect is transient and can be entirely eliminated by combining in the injection an equal amount of ether. The action of paraldehyde is so rapid that we preferred to retard it by dilution. We therefore mix 5 to 15 c c of paraldehyde with an equal amount of ether and dissolve the mixture in 150 c c of a cold 1 per cent solution of sodium chloride in sterile distilled water *free from dead bacteria*, or, in default of this, in ordinary boiled tap water. The solution should be perfectly clear after shaking. It is placed in a sterile bottle with a rubber stopper through which pass two glass tubes. To one of these tubes a bellows is attached. The other reaches to the bottom of the liquid and leads off by a long rubber tube to a fine hypodermic needle. The apparatus we have used is that devised by Fildes and Macintosh for the injection of salvarsan. The solution may be injected cold or at a temperature not exceeding  $25^{\circ}\text{C}$ . The patient's arm being surrounded with a light tourniquet bandage, a prominent vein is selected, the skin is cleansed with ether and the needle inserted. A back flow of blood through the needle into a glass tube in the rubber connection shows that the vein has been entered. The tourniquet is removed, the bellows worked, and the fluid is steadily driven into the vein at the rate of 5–10 c c per minute. The following phenomena are observed

In 5 seconds the patient tastes paraldehyde

In 10 seconds it can be detected in the breath. The patient has a sensation of general warmth

In 20 seconds the patient has a sensation of floating and perhaps of slight dizziness

In 30 seconds consciousness is disappearing

In 40 seconds unconsciousness is complete

In 60 seconds the patient is deeply unconscious

In 90 seconds the corneal reflex is absent and anæsthesia is complete. Reflex movements may, however, occur.

Up to this point about 5 c c to 10 c c of paraldehyde will



have been given and small operations, such as removing teeth or suturing wounds, may be performed. The drug is, however, excreted by the lungs with great rapidity, and for a lasting effect the whole 15 c c will usually be required.

The later effects of the drug depend largely on the amount given. With a small dose (5 c c) the patient passes through a short period of anæsthesia into an easy and natural sleep. The duration of this appears to depend on the condition of the patient and not on the drug, the action of which is over in perhaps 20 minutes. Thus in a case where six teeth were removed under 10 c c of paraldehyde and 10 c c of ether the patient was conscious in 20 minutes and had entirely recovered in half an hour. In another instance where the drug was used as a hypnotic six hours of natural sleep resulted. In both cases the patients appeared on waking to have simply been roused from sleep. No after-effects of any kind occurred in either case.

The most striking results were seen in the case of alcoholics, both acute and chronic. One powerful laborer with a scalp wound and incipient alcoholic dementia was sleeping peacefully in 40 seconds, realizing too late that anything was being done. His scalp wound was sutured without disturbance. In such cases, however, intravenous paraldehyde is too transient and should be backed up at leisure with slower drugs, such as potassium bromide and chloral given by rectal or nasal tube, or by paraldehyde itself given in the same way or into the muscles. It is, however, this rapidity of excretion which gives one such confidence in the use of so potent a drug intravenously. At each instant the patient exhibits the maximum effect of the dose so far given. The dosage is, therefore, under absolute control, and hence there is never any danger from an overdose. The moment injection ceases the effect of the drug begins to pass off as the drug itself pours out through the lungs. We therefore consider the use of intravenous paraldehyde to be practically safe, and we have ventured to use it as a hypnotic in cases of grave cardiac and pulmonary disease with perfect success. We do not suggest it can replace the slower but more

lasting hypnotics, but we draw attention to it as a method by which, under the most trying circumstances, we have never failed to induce within 60 seconds a condition closely resembling normal sleep. We feel that such a method must have a future both in medicine and in surgery.

We can find no record in the literature of the previous intravenous use of paraldehyde. We append a list of some of the more important papers on the subject of intravenous anæsthesia.

We should like to thank the staff of the London Hospital for the facilities we have been granted for the introduction of this new method.

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## TRAUMATIC RUPTURE OF THE SPLEEN (COMPLETE), SPLENECTOMY.

BY A M FAUNTLEROY, M D,

Surgeon, U S Navy

THE subject of this report is a young man, 24 years of age, who was received aboard the U S hospital ship *Solace* in the early morning of September 9, 1912, with a history of having fallen from the spar deck of the U S S *Ohio* to the water, a distance of forty feet, striking his left side on the gunwale of a whale-boat which was moored alongside the battleship. He was rescued immediately, and, upon being seen by the ship's surgeon, exhibited unmistakable signs of shock, for which he was given morphine, Gr  $\frac{1}{4}$ , and atropine, Gr  $\frac{1}{150}$ ,\* by arm, and preparations made for his immediate transfer to the *Solace*.

Examination on admission to the *Solace* showed the patient's general condition to be very good, with a temperature of  $98.4^{\circ}$  F, pulse 80 and of good quality, and respirations 29. He was catheterized immediately, and, though the small amount of urine withdrawn was clear, it was sent to the laboratory for examination. The report on this urine shortly afterwards showed it to contain a heavy precipitate of albumin, with numerous granular casts, but no red blood-cells were present. There was evidence of severe contusion over left abdomen and lower ribs, but there was no abrasion of the skin, nor were any bones broken. There was a noticeable rigidity over entire abdomen, and this was markedly increased over upper left quadrant, in which region there was also considerable pain and tenderness. There was no unusual dulness in left flank, and patient had not been nauseated. He complained of a curious, deep-seated pain in left shoulder, which was not increased by movement of the joint, and, as examination showed no contusion or dislocation, it was thought to be a slight sprain in this region, due to an effort to catch himself in falling. It is to be noticed, however, that this pain disappeared completely after operation, and it is possible that it has some diagnostic value when the spleen is traumatically involved.

As there were no signs of internal hemorrhage, it was decided to treat the case expectantly under close watch and at the same time be ready for operation, should one be indicated. In this connection, on account of the condition of his kidneys, it was deemed advisable not to subject the patient to an exploratory operation for diagnostic purposes, but rather to wait until there was more pronounced evidence of internal trouble, and thus not cause what might turn out to be an unnecessary depression of the kidneys incident to the anæsthetic.

For three hours after admission there was practically no change in temperature, pulse, or respiration, and the rigidity in upper left quadrant remained the same. Shortly after this time patient experienced slight nausea and vomited a small amount of light-greenish fluid. There was also at this time what appeared to be an increased desire for water, though there was not the slightest evidence of syncope or restlessness. Operation was decided upon for the following reasons: the continued marked rigidity, in connection with pain, in upper left quadrant, and a slight tendency to nausea (vomited once), indicating a possible accumulation of fluid in the abdomen.

*Operation*—Ether anæsthetic. Incision made along the outer border of left rectus, which was later augmented by transverse incision along lower border of ribs, making in all an L-shaped incision. On opening the abdomen there was at first no evidence of hemorrhage, but, on separating the slightly-distended coils of intestine, small clots began to appear. The spleen was immediately sought for, and a large clot located under the diaphragm and completely surrounding the spleen. A tentative effort was made to deliver the spleen, but, on account of what afterward was discovered to be the shortness of the pedicle and adhesions, this could not be done at this time. The next step was to free the stomach by ligating and dividing the vasa brevia as quickly as possible. This accomplished, the pedicle was secured by a large clamp, guided by the fingers of the left hand. Up to this time the displacement of the clot had caused considerable hemorrhage, but as soon as the pedicle was secured this was seen to be controlled. The clot and fluid blood were now carefully expunged and a better view of the parts obtained. It was noted that not only was the pedicle very short, but the entire posterior border of the organ was held down by reflected

peritoneum or adhesions. These latter were carefully broken up by finger dissection and the lower part of the organ brought up into the wound. It was now seen that the organ had been completely torn across about its middle, and that, in order to secure the pedicle, it would be necessary to include a portion of the tail of the pancreas in the ligature to prevent slipping. This was accomplished with heavy silk, the pedicle being ligated in two sections and the entire organ delivered. The wound, after thorough mopping of the abdomen, was closed in layers, heavy chromic gut being used for the deep sutures and linen for the skin. No drainage was used.

*After-treatment and Results*—Patient reacted slowly after operation, and for twenty-four hours normal salt solution was given slowly per rectum for its general tonic effects and to flush out the kidneys. For the succeeding ten days a strictly milk diet was given and the patient encouraged to drink plenty of water. The urine at first showed considerable albumin, with a few granular casts, but by the end of ten days this had entirely cleared up and the patient was put on a more liberal diet of potatoes, toast, butter, and coffee. After this, 24-hour specimens of urine, for two weeks, showed normal quantity and quality, and the examinations were then discontinued. During convalescence there was an indication, at times, of a nervous involvement, such as fleeting headaches, insomnia, and an apprehensive nervous attitude toward attendants. This, however, slowly passed away, and no untoward symptoms were noted, except an occasional colicky cramp over abdomen, which sometimes lasted for twelve hours. An enema and hot-water bag usually relieved these pains. No bone pains were noted, nor was there any enlargement of the superficial glands. The blood picture, as noted by a white, red, and differential count every day, showed nothing unusual or worthy of note. At the present time, one month after operation, patient is up and around, has regained his normal weight, bowels moved regularly, feels perfectly well, eats and sleeps normally, and will be shortly returned to duty.

A remarkable feature of this case was the comparatively small hemorrhage present when one took into consideration the

From the clinical and autopsy records of approximately 30,000 cases of malaria, admitted to the wards of Colon Hospital during the past eight years, we have found only three instances of spontaneous rupture. In each of these cases a close and careful questioning failed to elicit a history of trauma of even the mildest degree. In the Isthmian Canal service all employees injured in line of duty receive full compensation during the period of their disability, if not in excess of one year. Employees on the "silver roll" (laborers and so forth) receive no compensation for illness. In consequence of this rule claims of injury are made on the least excuse possible. The denial of injury by these patients is, therefore, of added value.

#### CASE REPORTS

CASE I—N H, case No 22,100, Barbadian, male, age 22, black, occupation laborer, on Isthmus 2 years, admitted to Colon Hospital February 2, 1910

*Past History*—Was never sick until after coming to Isthmus. Has never had typhoid or dysentery. Has had four light attacks of "fever" in past two years. Has never been admitted to hospital previously. Denies venereal or alcoholic history.

*Present Illness*—Was taken sick January 28 with headache, backache, fever, and pain in left side at costal margin. Continued at work until day of admission, though suffering with fever and headache daily. Has not been injured in any way.

*Physical Examination*—Patient well nourished. Lungs and heart negative. Abdomen tender in left hypochondriac region. Slight rigidity of left rectus and oblique. Spleen palpable at costal margin. Tongue coated. Sclera jaundiced. General glandular enlargement. The blood examination was positive, showing a light, æstivo-autumnal infection. Hæmoglobin 68 per cent. Leucocytes 13,100. Stool examination negative. Urine negative.

*Case History*—The temperature on admission was 102° F. Pulse 124. Respiration 30. From February 2 to February 6 the temperature ranged from 99.5° to 104°. On February 7, 8 and 9 the highest point reached was 102.5°, and the lowest

# SPONTANEOUS RUPTURE OF THE MALARIAL SPLEEN.

A REPORT OF THREE CASES \*

BY LLOYD NOLAND, M D,

Chief of Surgical Clinic, Colon Hospital, Panama Canal Zone,

AND

FRED C. WATSON, M D,

Colon Hospital

SPONTANEOUS rupture of the spleen occurring during attacks of malaria, or as a sequel of malarial infection, is, we believe, of sufficient rarity and interest to justify the presentation of this paper. All text-books on internal medicine, and especially those devoted exclusively to tropical diseases, mention and emphasize the fact that the malarial spleen is particularly liable to rupture as the result of severe or even trivial injury. Most workers of extensive tropical experience have frequently encountered such cases. That the malarial spleen may rupture spontaneously is admitted by many writers, but specific instances are rare. We have been unable to make an extended search of the literature on this subject, but the following isolated authentic cases have been found.

CIMBALI, quoted by Litten,<sup>1</sup> observed rupture of the spleen in a man of 65 who had enlargement of the gland, the result of malaria. One morning, as the patient was getting out of bed, he suddenly felt a severe pain in the left side, and soon turned pale and cyanotic and died. A tear, three or four cm. in length, was found in the upper end of an enormously enlarged spleen. Davys, quoted by George G. Ross,<sup>2</sup> reports a spontaneous rupture of the spleen in a native of India while lying down. Death occurred in one-half hour. Autopsy showed a soft and enlarged spleen with a rent in its anterior angle. Berger, also quoted by Ross,<sup>3</sup> reports a similar case. Borrallier, quoted by Douglas,<sup>4</sup> reports a case of spontaneous rupture of the spleen, following several attacks of ague.

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\* From the Surgical Clinic at Colon Hospital, Cristobal, C. Z.  
Read before the Canal Zone Medical Association, September 11, 1912

100° The pulse-rate was high for malaria, averaging 110. Routine quinine treatment, grains 15 t.i.d., was instituted on admission. The patient complained of increasing pain in the left side on February 9 and developed marked rigidity of the abdominal muscles. On this day the leucocyte count was 20,000. Differential count: Polynuclears 60 per cent, small lymphocytes 15 per cent, large lymphocytes 15 per cent, transitionals 9 per cent. Blood culture taken February 7 was reported sterile. The patient was transferred to the surgical side with a tentative diagnosis of splenic abscess. Operation was urged, but was refused by the patient on the 9th, 10th, and 11th, but was finally consented to on the 12th. During these days the pain became increasingly severe, with constant and marked abdominal rigidity, but without vomiting or constipation. There was intense local tenderness in the left hypochondriac and epigastric regions.

*Operation* (February 12, 8 A.M.) (Dr. Noland).—Ether anesthesia. The abdomen was opened by a free left rectus incision. The peritoneal cavity contained a small amount of dark fluid blood, probably not more than 500 c.c. The spleen was enlarged to almost twice its normal size, and was densely wrapped in omentum, which was separated with some difficulty. A rent of about one and a half inches in length and quite shallow was found on the diaphragmatic surface, almost opposite the hilum. In attempting to determine the extent of this rupture a free hemorrhage was started up. Owing to difficulty of access and the friability of the organ, tamponage rather than suture was deemed most expedient. The hemorrhage was easily controlled by a light gauze tampon, carried out through the upper end of the primary incision. The abdomen was closed in the usual manner. The tampon was removed at the end of 48 hours. The patient made a good and uninterrupted recovery, with the exception of a high postoperative temperature, reaching 105 on the third day, and dropping to normal on the fourth. He was discharged from hospital April 12, 1910.

CASE II—R. G., case No. 34,260, Spaniard, male, age 31, white, occupation, laborer, on Isthmus 5½ years, admitted to Colon Hospital August 6, 1911, at 7:30 P.M.

*Past History*.—One previous admission to hospital (Ancon, 1905, with yellow fever). Has never had typhoid or dysentery.



100° The pulse-rate was high for malaria, averaging 110. Routine quinine treatment, grains 15 t i d, was instituted on admission. The patient complained of increasing pain in the left side on February 9 and developed marked rigidity of the abdominal muscles. On this day the leucocyte count was 20,000. Differential count: Polynuclears 60 per cent, small lymphocytes 15 per cent, large lymphocytes 15 per cent, transitionals 9 per cent. Blood culture taken February 7 was reported sterile. The patient was transferred to the surgical side with a tentative diagnosis of splenic abscess. Operation was urged, but was refused by the patient on the 9th, 10th, and 11th, but was finally consented to on the 12th. During these days the pain became increasingly severe, with constant and marked abdominal rigidity, but without vomiting or constipation. There was intense local tenderness in the left hypochondriac and epigastric regions.

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CASE II —R G, case No 34,260, Spaniard, male, age 31, white, occupation, laborer, on Isthmus 5½ years, admitted to Colon Hospital August 6, 1911, at 7 30 P M.

*Past History* —One previous admission to hospital (Ancon, 1905, with yellow fever). Has never had typhoid or dysentery.

Has had several mild attacks of "fever" Denies venereal or alcoholic history

*Present Illness*—Was taken sick August 2 with chill, fever, intense headache, vomiting, and pain in umbilical region Continued at work until August 4, though suffering daily with fever He has sustained no injury

*Physical Examination*—Patient fairly well nourished, though slightly anæmic The abdomen showed distention and slight rigidity, with decided general tenderness, more marked around the umbilicus Spleen palpable at costal margin Heart and lungs negative Tongue coated. No icterus Urine shows slight trace of albumin, no casts or sugar Blood examination was positive, showing a moderately heavy æstivo-autumnal infection Leucocytes 8,400, stool examination negative

*Case History*—The temperature on admission was 100.5° F Pulse 120 Respiration 20 Routine quinine treatment, grains 15 t i d, was instituted The following morning the temperature dropped to 99° and the patient seemed very comfortable At 8 P M the temperature rose to 101° and the patient complained of increasing abdominal pain, centring about the umbilicus and radiating toward McBurney's point The following morning (August 8) there was marked abdominal rigidity and tenderness, with nausea and vomiting The abdomen was distended and dulness was noted in both flanks Leucocyte count 17,400 The patient was transferred to the surgical side with a diagnosis of general peritonitis of unknown origin

*Operation* (August 8, 10 A M) (Dr Noland) —Ether anesthesia Right rectus incision The abdomen contained approximately 1,500 c c of dark fluid blood with few clots A search for the source of the hemorrhage revealed a shallow rupture on the convex surface of the spleen, some two inches in length, extending backward from the anterior border about one inch above the anterior basal angle A cauliflower-like mass of blood-clot protruded from the rupture Palpation gave the impression of extensive infiltration beneath the splenic capsule The spleen was enlarged to about one and one-half times the normal size There were no adhesions Apparently, all hemorrhage had ceased, and no further bleeding resulted from manipulation The abdomen was sponged relatively free of blood

the appendix, which was adherent and markedly thickened, was removed, and the abdomen closed in the usual manner. There was a postoperative temperature rise to 104° on the day following operation, with a gradual decline to the normal, which was reached on the fourth day. The patient made a good recovery and was discharged on August 27, 1911. Smears of the free blood in the abdomen, made at operation at the suggestion of Dr J P Bates, showed a very heavy æstivo-autumnal infection.

CASE III—S W, case No 36,690, Jamaican, black, male, age 24, occupation, laborer, on Isthmus 4 months, residence Camp Totten, near Gatun. Admitted to Colon Hospital December 16, 1911, at 8 P M.

*Past History*—Has had four attacks of "fever," although this is his first admission to hospital. Denies venereal and alcoholic history. With the exception of the attacks of "fever" referred to, his health has always been good.

*Present Illness*—On the day of admission, while taking his usual midday rest, he suddenly felt a severe pain in his abdomen, most intense in the region of the umbilicus. He describes his pain as being of a sharp and lancinating character, with radiation upward and to the left, being quite severe beneath the costal margin. Respiration increases his discomfort. Soon after the onset of pain he vomited and complained of feeling intensely weak. His bowels moved on the morning of the day of admission. He had been feeling quite well and had worked all morning. No history of injury or strain could be obtained.

*Physical Examination*—Patient well developed and well nourished. Facies anxious. Severe pain and discomfort plainly evident. Heart and lungs negative. There was some distention of the abdomen, particularly above the umbilicus. Abdominal tenderness and rigidity were marked. Dulness was elicited in each flank, being slightly more pronounced on the left side. Leucocytes 24,000. A catheterized specimen of urine showed a faint trace of albumin, but no casts and no sugar. The temperature on admission was 99° F. Pulse 100. Respiration 26 and restrained. General condition of the patient was fairly good. A definite diagnosis before operation was not made, although it was thought that there was probably a perforation of some hollow viscus with a rapidly-spreading peritonitis or

slow hemorrhage The condition was plainly acutely surgical, and immediate operation was decided upon

*Operation* (December 16, 9 P M) (Dr Watson) —Ether anæsthesia A right rectus incision was employed on account of its giving opportunity for a thorough exploration, although the symptoms were slightly more pronounced in the epigastric and left hypochondriac regions Upon opening the peritoneum there was a gush of bright red blood, estimated as at least 1,000 c c A search for the cause of the hemorrhage revealed a shallow laceration on the convex surface of the spleen, slightly below the midline and extending entirely across the organ Numerous large clots surrounding the spleen were removed and the hemorrhage easily controlled by a light gauze tampon The patient left the operating room in good condition, pulse 104, regular, good quality Continuous salt solution per rectum was retained well The condition of the patient for 24 hours following operation was encouraging, except for the fact that only nine ounces of urine were excreted Complete suppression followed The patient died at 1 30 A M, December 19, 52½ hours after operation An autopsy by Dr R B Hill, 8 hours after death, showed a very small amount of free blood in the peritoneal cavity, with several large clots in the left hypochondrium The spleen, when removed, weighed 140 grammes Opposite the hilum on the convex surface of the spleen there was a superficial tear extending transversely a distance of three inches Beneath the capsule, and separating it from the gland, there was considerable clotted blood Smears made from various parts of the splenic pulp were stained and æstivo-autumnal parasites demonstrated (Repeated examinations of the peripheral blood before death were negative) The right kidney was small, its cortex was thin, and scattered through the parenchyma were a few small cysts filled with clear, straw-colored fluid The capsule stripped with a slight degree of resistance, exposing a somewhat granular surface The left kidney showed similar changes Opposite the hilum on the convex border there was a cyst the size of a large hen's egg, containing clear, straw-colored fluid The bladder was empty. The heart showed a moderate degree of hypertrophy There were a few fibrous adhesions in each pleural cavity All other organs were normal

*Etiology and Pathology*—Lidell, quoted by R C Bryan,<sup>5</sup> in his very able monograph on spontaneous rupture of the spleen in the course of typhoid fever, states that the causes of spontaneous rupture seem to be several “(1) Softening of all the structures of the organ, including the coats of the blood-vessels, (2) intense congestion of the portal vein and radicles that occurs in the early stages of typhoid as well as malarial fever, (3) stagnating blood distending the soft walls of the blood-vessels in the splenic surface, thus forcing blood between the spleen tissue and capsule and investing peritoneum, (4) blood increasing compresses the parenchyma on one side and dilates the capsule and peritoneum on the other”

The above, as a whole, would seem to be a plausible theory in regard to the cause of spontaneous rupture of the malarial spleen. We are inclined to believe, from the evidence afforded by our small series of cases, that rupture of the splenic capsule is secondary to rupture of the engorged capillaries, with hæmatoma formation and consequent increased tension. In Case III there was marked extravasation of blood between the capsule and parenchyma over a considerable area. Case II, at operation, showed a cauliflower-like mass of blood-clot protruding from the rent in the capsule, and palpation over the entire convex surface of the organ gave the impression of extensive infiltration beneath the capsule. In a fairly extensive series of cases of traumatic rupture of the spleen we have never observed infiltration of this character. It would seem that the spleen does not necessarily have to undergo an enormous degree of enlargement for spontaneous rupture to occur. In none of our cases was the organ enlarged to more than twice its normal size. The marked thickening of the capsule and the increased amount of connective tissue in the parenchyma would seem to offer an explanation of the comparative rarity of spontaneous rupture of the large “ague-cake,” so frequently observed in the tropics. As to the situation of the tear, Cantlie<sup>6</sup> calls attention to the frequency of rupture on the visceral (internal) surface in malarial spleens, the result of trauma. It is interesting to note that in the spontaneous ruptures observed by

us the tear in each instance was located on the diaphragmatic (convex) surface

*Symptoms and Diagnosis* —The symptoms of spontaneous rupture correspond closely with those commonly observed in traumatic rupture. The absence of a history of injury in the spontaneous ruptures, together with their decided rarity, renders the diagnosis much more difficult. Severe abdominal pain, slightly exaggerated above and to the left of the umbilicus, general abdominal tenderness with marked rigidity of the abdominal muscles and some degree of dulness in the flanks, together with a history of previous malarial attacks, or the presence of malarial parasites in the peripheral blood, should lead one to suspect spontaneous rupture. Symptoms of shock and collapse may develop if the tear is extensive and the consequent hemorrhage rapid and severe. Fixed dulness in the left flank, with progressive enlargement of the area of dulness (Ballance's sign) if present, would be pathognomonic of splenic rupture. The symptoms are at times confusing, but even in cases in which the hemorrhage is not sufficiently severe to make an early positive diagnosis easy the indications for immediate exploration are usually unmistakable. The treatment is strictly surgical. Although spontaneous recovery may occur, as noted in Case II, in which the hemorrhage had entirely ceased at the time of operation, such a favorable outcome should not be expected in all cases. The treatment of the rupture will depend upon its extent and location. Splenectomy, we believe, should be reserved for the more extensive lacerations, and cases in which conservative measures for the control of hemorrhage fail. Suture of the congested and friable spleen is always difficult and, at times, impossible. Tamponage, as a means of controlling hemorrhage, has given quite satisfactory results in our cases of spontaneous as well as traumatic rupture. The after-treatment is that of any abdominal section.

#### CONCLUSIONS

*First* —That spontaneous rupture of the malarial spleen occurs in rare instances

*Second.*—That the spleen does not necessarily have to undergo a great degree of enlargement for spontaneous rupture to occur

*Third* —That very deep palpation or forcible percussion of the enlarged malarial spleen should be avoided

*Fourth* —That exploratory puncture of the spleen for diagnostic reasons is not without danger

*Fifth.*—That the treatment of spontaneous rupture of the malarial spleen is surgical, and that early operation is indicated in all cases in which the condition is suspected

We desire to thank Col W C Gorgas, Chief Sanitary Officer, Isthmian Canal Commission, for permission to publish this paper

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# THE USE OF A MURPHY BUTTON TO EFFECT DUODENOJEJUNOSTOMY AFTER GASTRO- JEJUNOSTOMY.

BY WILLARD BARTLETT, M.D.,  
OF ST LOUIS, MO

NOTHING can distress patient and operator more than persistent vomiting of bile following a gastrojejunostomy. This condition is rarer than formerly, but does occur, although the improved technique of the higher operation has made it less frequent, however, a remedial entero-enterostomy is made more difficult when a vicious circle complicates the higher operation than was the case when a long loop was present.

I have attempted on rare occasions several methods of relieving this unfortunate condition, but have experienced great difficulty with every means except the one described herein.

In a recent case, in which I operated, February 28, 1912, there followed vomiting of bile, which persisted until April 16, 1912. On the latter date the abdomen was reopened and the field found to be deeply placed, fairly well fixed, and with practically no loop.

I was forced to devise a method of short-circuiting the duodenum, which I did in the following manner:

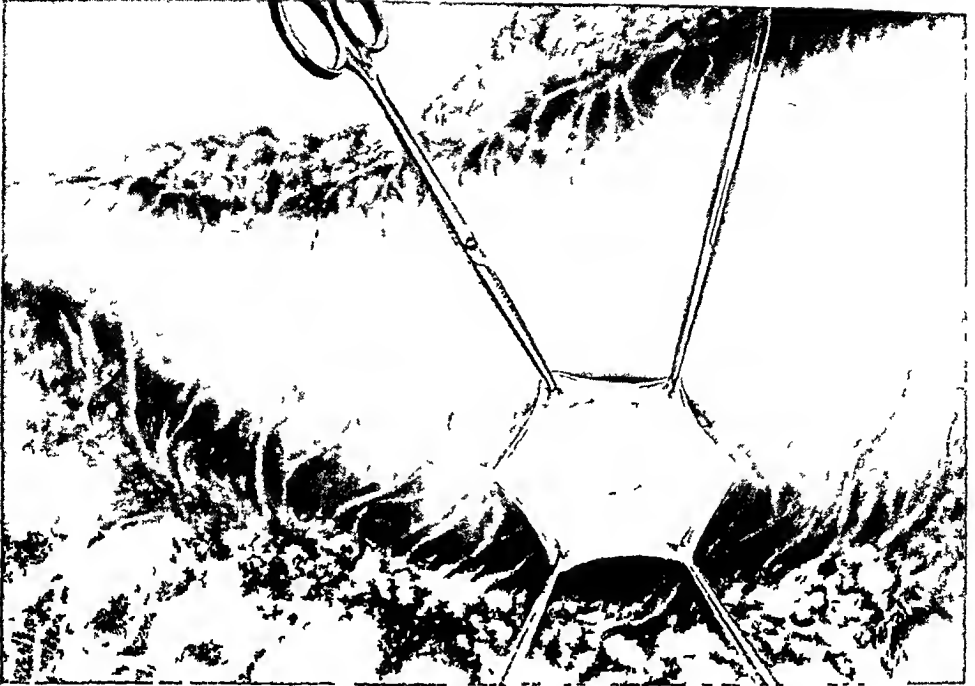
After exposing the stomach, an incision was made in the anterior wall of this structure (Fig. 1), allowing access to the gastero-enterostomy opening in the posterior wall.

With a hysterectomy clamp, one-half of a Murphy button was introduced through the opening in the posterior wall into the duodenum (Fig. 2), then the other half of the button was introduced into the jejunum. Two small incisions were made through the intestinal wall exposing the neck of each half of the button.

Then the two portions of the bowel contiguous to the gastro-enterostomy opening in which the halves of the Murphy buttons had been placed were brought together and a short



FIG 1



The incision in the anterior wall of the stomach allows access to the gastro-enterostomy opening in the posterior wall

FIG 2



The two halves of a Murphy button have been introduced by the peritoneal route, caught the two portions of bowel contiguous to the gastro-enterostomy opening and will be telescoped in order to short-circuit the loops for the treatment of vicious circle

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Then the two portions of the bowel contiguous to the gastro-enterostomy opening in which the halves of the Murphy buttons had been placed were brought together and a short

circuit established by telescoping the two halves of the button

I have found this method extremely easy to accomplish, the only difficulty experienced being in protecting the field with packs.

Following the operation, the patient vomited only once before leaving the hospital, and that a few hours after operation

# ILEUS DUE TO MECKEL'S DIVERTICULUM.

BY ARTHUR BARNETT EUSTACE, M D.,

OF CHICAGO

THERE are, no doubt, numerous cases of ileus due to Meckel's diverticulum which are not reported, and, consequently, will not be found in the literature. If these cases are not compiled and published, how shall we be able to arrive at a logical conclusion as to their relative frequency and the different manners in which they may occur?

With the above foreword as a stimulation to others, I herewith submit the data of a case of ileus due to a Meckel's diverticulum in which there were present a volvulus of the diverticulum itself and an obstruction of the ileum produced by it.

H B, age 11 years, a school-boy, was first seen by me on August 16, 1912, and gave the following clinical history: That he had always been in perfect health until the previous ten days, at which time he was taken with severe cramps in the abdomen, during the duration of which he could not walk nor move without increasing their severity. The first attack of "cramps" was associated with vomiting, and lasted for four or five hours, and were relieved upon his going to bed. A second attack followed three days later, and the cramps and vomiting were more marked than the first. The boy noted that his bowels did not move during this period of "cramps," but moved freely after the cessation of the second attack. The pain and discomfort disappeared without any other symptoms developing.

The boy remained perfectly well for seven days, and at 10 P M on the night of August 15 was taken with "terrible cramps" in the abdomen, and a few hours later started vomiting at frequent intervals during the night, the vomitus is described as being black and having a most disagreeable odor.

I first saw the child twelve hours after the onset of this attack, and examination revealed the following. The patient lay in bed

with his legs drawn up, and stated that it relieved the severity of the pain. He complained of pain all over the abdomen, but most marked about one and one-half inches above McBurney's point. The abdomen was markedly distended, and a marked rigidity of the recti muscles, especially the right side, was noted.

The entire abdomen was markedly tender, especially just above McBurney's point. His temperature was  $99.8^{\circ}\text{F}$  and his pulse 132. Leucocyte count, 17,800.

A diagnosis of acute appendicitis, with possible perforation, was made, being based upon the sudden onset with pain and vomiting and the well-localized tenderness and rigidity, and immediate operation advised. The patient was taken to the hospital within an hour and the following operation made. An effort was made to clear out the lower bowel with a rectal enema just before the operation, with a fair result.

A right rectus incision was made and a large amount of serous fluid escaped when the peritoneal cavity was opened. The peritoneum was "fiery red" and covered with small deposits of fibrin.

Upon attempting to deliver the appendix into the wound a great deal of difficulty was encountered, and after several futile attempts it was decided to enlarge the incision in order to afford a better view of the abdominal contents.

The appendix was noted lying several inches above its normal position and bound down by many adhesions. It was freed and delivered into the wound and found to be perfectly normal except for a moderate injection of the vessels of the serosa.

A marked dilation of a loop of ileum was then noted and an examination of the small bowel made. The ileum was carefully inspected, beginning at its junction with the cæcum, and the cause of the trouble found to be a Meckel's diverticulum located about 20 inches from the ileocæcal valve.

The diverticulum was 9 cm long and about 3 cm wide at the base, and tapered gradually to its tip, which was attached to the umbilicus.

The diverticulum was twisted upon itself like the coils of a rope, and was of a dark-brown color, and the normal glossy appearance of a normal serosa had given way to a rough hazy one. Thus we were able to demonstrate a distinct volvulus of the diverticulum itself (see Fig 1).

A large loop of ileum was shown to be strangulated by the

twisted diverticulum, as shown in the accompanying drawing

The diverticulum was clamped and cut and the coils of bowel released. Examination of the strangulated portion of the ileum showed it to be in good condition and resection unnecessary.

The diverticulum was then removed by the same technique by which the appendix is usually removed—ligation, amputation, and invagination of the stump. A row of sutures was made over the site of removal to cover over some raw surfaces made by the tearing of adhesions.

The appendix was also removed and the abdomen closed. The patient made an uneventful recovery and left the hospital in 18 days.

Volvulus of Meckel's diverticulum is somewhat rare. When not associated with a strangulation of the bowel it may produce the signs of an acute diverticulitis, viz, pain, rigidity, nausea, and the gradual appearance of the signs of peritonitis.

A diagnosis of ileus due to Meckel's diverticulum seems to me to be impossible unless you have definite knowledge of a persistent umbilical fistula in infancy which may have healed, or an open diverticulum present.

The signs of obstruction due to a Meckel's diverticulum do not differ from those of obstruction due to other causes. A symptom-complex of an abdominal crisis as outlined above constitutes a clear indication for immediate surgical intervention.

## EXTRASACCULAR HERNIA.

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EXTRASACCULAR or sliding hernia of the large intestine or bladder has had but little attention directed towards it, but of late years sufficient interest has been aroused in this condition to show that it is considerably more common than was at first believed. The lesion, when first seen at operation, is very puzzling, not only as regards diagnosis but also as regards the method of treatment. In fact, many methods have been adopted with the idea of preventing recurrence, with apparently but poor results. Thus Carnett,<sup>6</sup> in his valuable article on the subject, states that recurrences are very frequent, and Lockwood<sup>17</sup> goes so far as to say that the cases are very formidable and "prudence dictates that they should be avoided."

In the first case of this condition upon which I operated a simple method of closure of the sac was adopted, which on theoretical grounds seemed insufficient. A consideration of this case led me to devise a method of operating which I have been able to perform on three subsequent occasions. This method I believed at the time to be new, but, later, careful search of the literature has shown it to be only a modification of a method previously advocated. The good results following the use of it have, however, led me to publish these cases, so that further attention may be directed towards this condition. The first of the four cases is as follows

CASE I.—A N, a male, aged 46, stated that 12 years ago he first noticed a swelling in the right inguinal region. It came on during an effort with considerable pain, and has been steadily increasing in size since. On examination he was a poorly-de-

## EXTRASACULAR HERNIA

veloped man, with weak abdominal walls There was a large right inguinal hernia passing along the whole length of the inguinal canal which was only reducible in part There was nothing else of note in his condition

*Operation* (November 8, 1909) —A 4-inch incision was made over the right inguinal canal, the aponeurosis of the external oblique cleared and divided The sac was found opened, and a coil of small gut with a portion of omentum reduced It was then noticed that the cæcum was projecting into the postero-external part of the sac so that its anterior surface was alone covered with peritoneum About one inch of the cæcum projected from the abdomen The sac was freed as far as possible, the redundant portion removed, and the opening closed with a continuous suture The cæcum and attached peritoneum were then pushed back into the abdomen and the conjoint tendon sutured to the deep surface of Poupart's ligament over the cord after the manner of Macewen,<sup>10</sup> sharp curved needles and chromic catgut sutures being used

The wound healed well, and he was discharged three weeks later

At the present date, in answer to inquiries, he states that the pain and swelling have returned, but to a less degree than previously.

The above operation seemed at the time insufficient, for not only was the cæcum inadequately reduced, but even when the excess of sac was removed a distinct pouch was kept which was simply pushed back into the peritoneal cavity, the attempt at a radical cure resting wholly upon the repair of the muscular wall, a method which has frequently been shown to be inadequate, and recurrence, as took place in this case, being probable It seemed necessary to free the cæcum before replacing it, as well as to overcome any dimpling of the peritoneum at the site of the sac I therefore devised the following operation

The usual incision having been made, the aponeurosis of the external oblique is slit up in the line of its fibres and the sac laid bare This latter structure is carefully freed from the surrounding structures of the cord and opened at the fundus The opening is enlarged along the anterior surface of the sac



so that the contents are freely visible. The condition then seen will be that depicted in Fig 1. The sac is now divided with scissors on the posterior aspect to within one-half inch of the caput cæci, the incision being then carried along either side of the cæcum as far as the neck of the sac and at a distance of one-half inch from the lateral walls of the cæcum (Fig 1). On pulling the cæcum forward two flaps of peritoneum are thus seen (Fig 2), which are sutured together so as to surround the bare posterior surface of the cæcum, and the two edges of the divided sac are also sutured together behind the cæcum. This latter structure now lies free in the sac and can readily be reduced into the abdomen. The sac, being restored, can be invaginated and pushed through the internal oblique by Kocher's <sup>16</sup> second method. By this means the neck of the sac, with the attached part of the cæcum, is pulled up well away from the internal ring, while the freed cæcum is returned to the abdominal cavity. The muscular and aponeurotic wall is then carefully restored.

The three cases in which this operation was carried out were as follows

CASE II—W. M., aged 36, stated that four years ago he noticed a swelling in the right groin. His attention was first directed to it by the presence of pain while lifting a heavy weight. The swelling has been increasing since, but is lessened when he lies down. He has never worn a truss. On examination a right inguinal hernia was seen which was only in part reducible. The abdominal muscles were well developed.

*Operation* (December 10, 1910)—The cæcum alone was found in the sac and was in part extrasaccular, the posterior wall being bare. An operation on the above lines was carried out, and the conjoint tendon sutured over the cord to the deep surface of Poupart's ligament with chromic gut. Three months later he returned with a hydrocele of the right tunica vaginalis, for which an operation was performed. The site of the hernia was in perfect condition. At the present date he writes to say that he has never had any return of the pain or swelling and is able to carry on his work as a dock laborer in perfect comfort.

CASE III—F P, a male, aged 30, stated that he noticed the sudden onset of pain in the right inguinal region two years ago while carrying a heavy weight. Soon afterwards he noticed a swelling, which has steadily increased in size. He has never worn a truss. On examination there was seen a large right inguinal hernia which passed down to the top of the testis. The testis was small and atrophic. A thick-walled sac could be felt.

*Operation* (September 5, 1910) —The sac was large and the upper part contained a large mass of omentum and a portion of cæcum corresponding in size and position with the last case. An operation was carried out on the above lines and the muscular canal restored. At the present date he writes that there has been no return of any pain or swelling. He has not worn his truss since operation, and has returned to his usual work.

CASE IV—L N, a male, aged 68, stated that he had a rupture for fifteen years, for which he had always worn a truss. For four weeks there had been pain in the swelling, and for seven days this had been severe. He had been unable to completely reduce the hernia for six months. On examination there was a large left inguinal hernia which was only partly reducible, his general condition was poor, and he showed signs of two previous attacks of right-sided hemiplegia, but owing to the amount of pain operation was decided upon.

*Operation* (April 4, 1911) —On opening the sac a loop of large intestine was seen, the upper two inches of which had no mesentery, the gut, which was evidently iliac colon, being in this position partly extrasaccular. An operation on the above lines was carried out. Convalescence was uninterrupted, and at the present date he writes to say that he has never had the slightest trouble with the hernia since operation, and has not used his truss since.

It will be seen, therefore, that in the first case, with simple closure of the sac, reduction of the gut, and suture of the muscles, there is a definite return of swelling and pain. In the three cases treated by the more complete method there is no trace of any recurrence, although one patient is 68 years of age, and the other two have returned to hard work for a period of nearly two years.

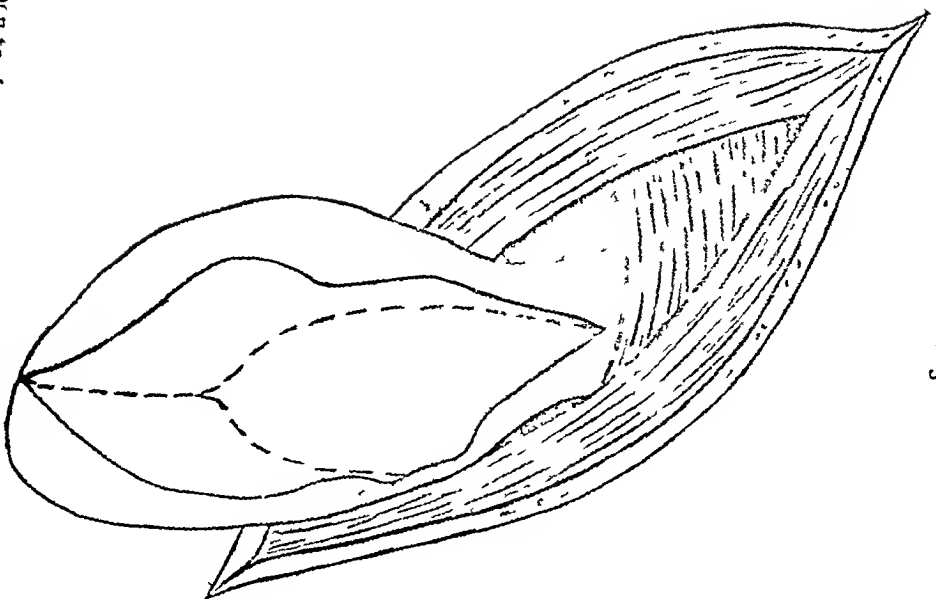
In the case of an extrasaccular hernia of the bladder a simi-

lar operation can be done, but in this case the bladder is pulled outside the sac before the edges are sutured. An incision in this case is made on the inner and posterior walls of the sac close to the prolapsed bladder and continued on either side of this viscus up to the neck of the sac (Fig 1). The sac is now pulled forward and the bladder backwards and the edges of the sac sutured together (Figs 6 and 7). By this means the bladder is left wholly without the sac, which is invaginated in the usual way. The freed bladder is now returned beneath the muscles into the cave of Retzius and the muscular and aponeurotic wall of the abdomen firmly repaired. The following is a case treated in this manner.

CASE V—P C, a male, aged 44, stated that ten years ago he first noticed a swelling in the right inguinal region which came on during an effort and was associated with considerable pain. It has been steadily increasing in size since. Eight years ago he first noticed a swelling at the upper part of the umbilicus, which has also slowly increased in size. On examination, a stout man with a large, prominent abdomen. There is a small hernia at the upper part of the umbilicus which is not wholly reducible. There is also a large right inguinal hernia which is wholly limited to the lower part of the inguinal canal and therefore appears to be direct. It passes only part of the way down the scrotum, and is reducible in greater part, but not wholly.

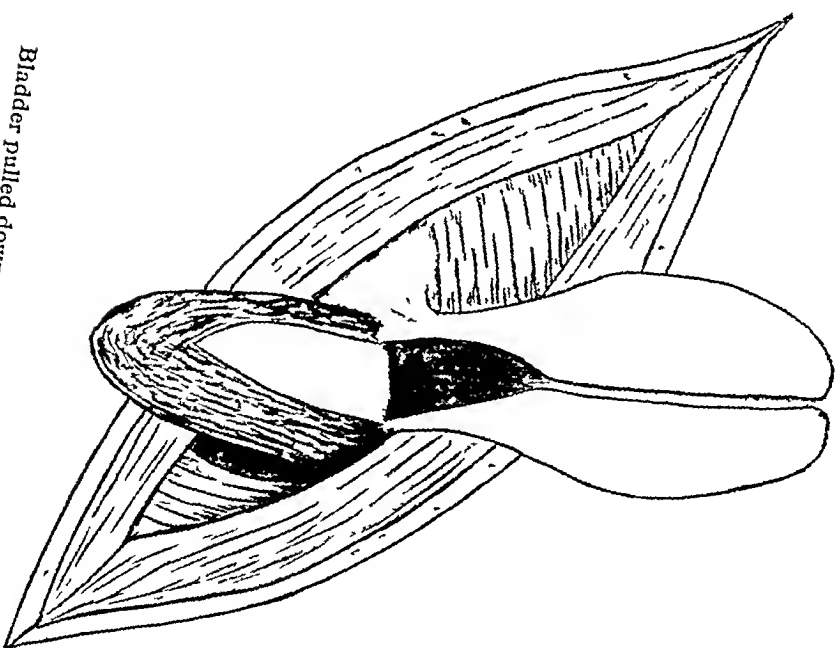
*Operation* (January 6, 1910)—A transverse elliptical incision  $4\frac{1}{2}$  inches long was made round the umbilicus and this hernia repaired according to the method advocated by Mayo<sup>21</sup>. A 4-inch incision was then made in the right inguinal region, the aponeurosis of the external oblique being cleared and slit up. A large sac was seen in the position of the external ring. It was covered with a thin aponeurotic layer, which was seen to be the stretched conjoint tendon, through a well-defined opening of which the hernia escaped. Below and internal to the sac a large pouch of bladder was found to be attached. The rest of the operation was carried out on the lines described above. The opening in the conjoint tendon was sutured with chromic catgut. The conjoint tendon was also sutured to the deep surface of Poupart's ligament, over the cord, after the method of Macewen,<sup>19</sup> an ordi-

Fig 5



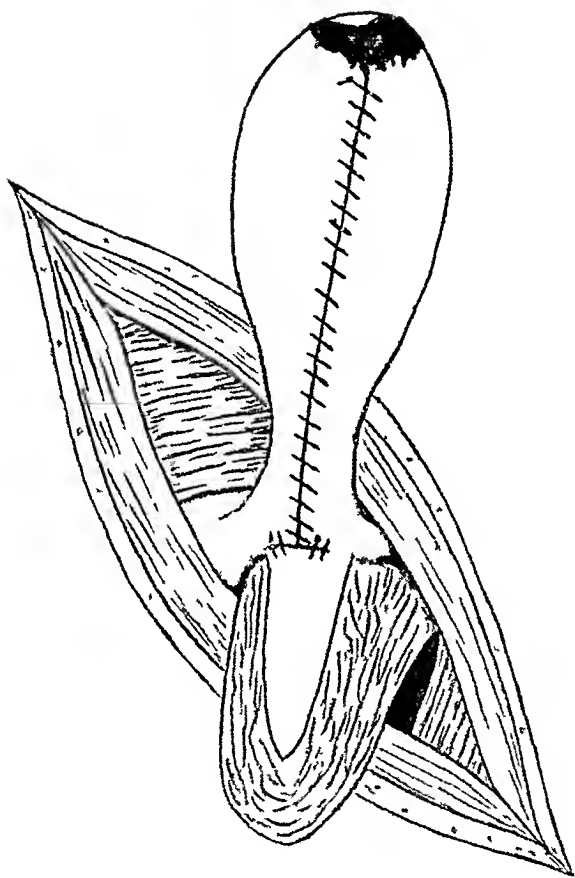
Sac laid open to show position of bladder indicated Line of incision

Fig 6



Bladder pulled downward and sac upward

FIG 7



Sac reconstructed and ready to be invaginated Bladder freed, displaced outside sac, and ready to be returned to cave of Retzius

nary sharp-curved needle being used. The wound healed well and he was discharged three weeks later. In answer to inquiries he states that at the present date he has no trouble with either hernia and is able to carry out his usual work in comfort.

Extrasaccular herniæ are those in which some portion of the wall is formed by a viscus which in its normal position is only in part covered by peritoneum. It is thus seen that this viscus, in the inguinal or femoral region, may be either bladder, cæcum, or iliac colon.

*Hernia of the Bladder* — This condition is now recognized as being a very common complication of both femoral and inguinal herniæ. Although it has been known for many years and was, in fact, mentioned by Albucasis in the twelfth century, and Guy de Chauliac described the passage of a catheter as an aid to diagnosis in 1363, yet its frequency has only of late been appreciated. In the extensive article on hernia by Birkett,<sup>3</sup> in 1883, there is no mention of this condition. Cases of the presence of the bladder in an inguinal hernia were, however, described by Cloquet,<sup>7</sup> and in 1889 Lockwood<sup>17</sup> mentions a case where the bladder was injured in drawing down the sac to ligature it. Within the next few years the condition became well recognized, and in 1900 McAdam Eccles<sup>18</sup> stated that it was probably associated with nearly 1 per cent of inguinal herniæ. He described three varieties.

I With peritoneal covering. These occurred within the sac of a large inguinal hernia, and through a greatly dilated, deep abdominal ring.

II Where the bladder forms part of the wall of the sac. This is the commonest variety, the bladder being situated on the inner wall and having only a partial peritoneal covering.

III Where the bladder descends without any peritoneal covering whatever.

This classification is maintained to-day, although there is some doubt as to whether it is ever possible to find a hernia consisting of bladder alone, it being generally considered that a peritoneal sac, though often small, is always present.

The cause of the presence of the bladder appears to be undoubtedly that this viscus is dragged downwards by the peritoneum in the formation of the sac. The sac is generally large and the hernia of old standing. It must be remembered that the peritoneum is firmly attached to the posterior and superior surfaces of the bladder, and thus as the sac increases at the expense of the parietal peritoneum it will gradually come to drag the attached bladder with it, and thus a portion of this viscus will come to form the inner and posterior wall of the sac. In many cases an early stage of this condition may be seen, that is to say, the extraperitoneal fat which surrounds the bladder is often seen to occupy the position which the bladder, if prolapsed, would attain to, although so far the bladder is still within the abdomen.

This explanation, although undoubtedly referring to the great majority of these herniæ, does not seem to make clear those rare cases in which a small peritoneal sac is alone present, or those in which the bladder is present within the sac. These latter do not come within our present consideration, but the former may be explained by the suggestion put forward by McAdam Eccles<sup>18</sup> and supported by Sir B. G. A. Moynihan,<sup>26</sup> namely, that the bladder is dilated and hypertrophied by obstruction from a stricture or an enlarged prostate and thus may come to overlie the opening of the abdominal ring.

The presence of the bladder in femoral herniæ seems to have been recognized even more lately. No mention of the condition is made by Birkett<sup>3</sup> or Lockwood<sup>17</sup>. McAdam Eccles<sup>18</sup> states that on several occasions this viscus has passed into a femoral sac. Moynihan<sup>26</sup> carefully investigated the condition and collected twenty-nine cases, two of which were males and twenty-seven females. Since then a very large number of individual cases have been recorded, and, as Erdmann<sup>8</sup> mentions, it is now recognized that the bladder is more commonly prolapsed in this type of hernia than in the inguinal variety.

The bladder will be situated on the inner side of the sac wall, and the cause of its presence will be similar to that of the inguinal type.

*Symptoms* —The symptoms of the presence of the bladder are often ill defined, and in the majority of cases this viscus is only found at operation, the condition having been previously unsuspected. Such herniæ are, however, large and always irreducible in part, so that the fact that the patient has a relatively large hernia which is reducible in part only should raise the suspicion that the bladder is associated with a part of the sac wall.

In other cases more definite signs and symptoms may be present. According to McAdam Eccles,<sup>18</sup> it may be possible to discern a fluctuating swelling in the hernial region which swelling is dull on percussion. Micturition may take place in two stages: the bladder is emptied and then by some movement the urine passes out of the hernial portion and is expelled, the tumor at the same time being noticed to disappear. In other cases pressure upon the hernial sac may be associated with a marked desire to micturate, as in a case recorded by Noall.<sup>27</sup> In such cases artificial distention of the bladder may be followed by an increase in size of the hernial swelling.

Even at operation the condition is not always easy to diagnose. The muscular fibres of the bladder wall are in large part covered by and infiltrated with fat, so that there is a danger of the condition being mistaken for the extraperitoneal fat alone, so that most surgeons have seen or heard of cases in which the viscus has been either inadvertently opened at operation or injured while the neck of the sac was being closed, an accident which is not uncommonly followed by fatal results. When once the frequency of the condition is realized, however, the presence of a considerable mass of tissue in this situation will at once give rise to the suspicion that the bladder is present. A finger inserted inside the opened sac will enable the amount of this tissue to be more readily estimated, and it may be determined thereby that it forms part of a hollow viscus. If any doubt should still remain, it would be possible to make the condition certain by injecting fluid into the bladder through a catheter.

The treatment will depend upon the amount of bladder



which is prolapsed. If small, this may be separated from the sac as high as the neck of the latter, which is then dealt with in the usual manner. The prolapsed portion of bladder which is now quite free is pushed back into the extraperitoneal space and the opening in the muscular and aponeurotic portion of the abdominal wall firmly closed. If larger, such a procedure might be associated with considerable injury to the bladder wall. It is therefore wiser to cut the free portion of the sac away from that attached to the bladder and then restore and treat the sac in the manner already described.

*Hernia of the Cæcum*.—The presence of a portion of the cæcum in association with a hernial sac has also had more attention devoted to it of late. Cases were, however, figured by Scarpa<sup>31</sup> in 1814. Mitchell Banks<sup>23</sup> described the condition fully and first made use of the term now so commonly used of landslip of the cæcum.

In the case of this viscus the relationships are complicated by the varying attachments of the peritoneum to the cæcum when this latter is situated in its normal position. Thus of the five cases described by Lockwood<sup>17</sup> the cæcum in four retained in its entirety its serous covering, but in the fifth it was partially denuded. Tuffier<sup>36</sup> has described a case in which there was no trace of a sac, but Treves<sup>35</sup> states that in all cases a sac is present, although in many such it may be very small.

The developmental changes occurring in and around the cæcum throw considerable light upon the presence of these different types. The cæcum develops as a small diverticulum as early as the end of the first month of foetal life (Bryce<sup>6</sup>), that is, before the axial rotation of the gut is complete and while there is still a common mesentery. It thus happens that the cæcum itself, which is usually about two and a half inches long, has a complete covering of peritoneum and has no mesentery attached to it, but lies free in the peritoneal cavity.

In early embryonic life the whole of the large gut has one common mesentery, which persists until the seventh week, when axial rotation of the U-shaped loop takes place, by which means the cæcum is carried over to the right side of the abdomen.

At this stage then the ascending colon has a well-defined mesentery, while the cæcum forms a free diverticulum covered with peritoneum. The ascending colon now falls over to the right, so that the lateral aspect of its mesentery comes to lie in contact with peritoneum covering the posterior abdominal wall. These two layers then fuse and become absorbed, so that the peritoneum comes to be directly reflected off from the cæcum onto the posterior abdominal wall, and the usual condition in one of only a partial covering of peritoneum for the ascending colon, while the cæcum is free. In a small number of cases the colon may retain its mesentery, and Carnett<sup>6</sup> states that always in the newly-born, and usually in the adult, the two adherent layers can be separated and the primitive mesocolon reestablished.

As the cæcum falls over to the right the appendix may get caught between the two layers and come to occupy an extra-peritoneal position (Keith)<sup>15</sup>. In addition to these changes, the ascending colon may, after fusion has taken place, again develop a mesentery, in its lower part at least, probably by stretching of the peritoneal folds. In a certain proportion of cases—according to Jonnesco,<sup>14</sup> 8 per cent—the cæcum may in its upper part undergo changes similar to those of the ascending colon, so that it also may be in part uncovered by peritoneum.

A consideration of the above factors makes it clear that many different varieties of hernia of the cæcum may take place, and, as Sobotta<sup>33</sup> has shown, the cæcum, when distended, lies in contact with the anterior abdominal wall, so that its appearance in the sac of an inguinal hernia is not unlikely. Although most common in an inguinal hernia, this viscus may also pass through the femoral opening. The statistics of Hildebrand<sup>11</sup> and Gibbon,<sup>12</sup> combined by Carnett,<sup>6</sup> showed 164 inguinal and 21 femoral varieties.

The condition found at operation will, of necessity, be of one of the three following types

I *Simple Hernia*—Here the cæcum has descended into the hernial sac in a manner identical with any coil of small gut (Fig. 8). In some cases only the appendix is present, as in

4 cases recorded by J A Macewen,<sup>20</sup> and while in this situation may even become acutely inflamed, as in cases described by Ewart<sup>9</sup> In others the cæcum itself will also be prolapsed

It will be seen that the condition may arise in one of three ways.

- (a) From a persistence of the embryological condition of a mesentery to the ascending colon
- (b) From the presence of an acquired mesentery to the ascending colon
- (c) From the presence of a large cæcum or appendix, so that one or both are able to pass down into the sac, while the ascending colon maintains its normal position and relationships to the peritoneum

The gut, in either case, is reduced with the same simplicity as the small gut, no difficulty arising in the operative treatment

II *Extrasaccular Hernia*—This presupposes the presence of a sac, but the cæcum or ascending colon is either definitely outside the sac in part or the mesentery of these structures is firmly attached to a portion of the sac, so that simple reduction becomes impossible

For such a condition to occur it is necessary that the cæcum slide down from its normal position This sliding down of the cæcum may be due to congenital or acquired causes The congenital are described as being two in number

- (a) In foetal life a fold, known as the plica vascularis, is seen to run up from the mesorchium along the posterior wall, to end in the cæcum, appendix, mesentery, and ileum Lockwood<sup>17</sup> regards the persistence of this fold as a developmental defect, and figures cases of cæcal hernia in which its presence was well marked In one case in a child he was able to demonstrate gubernacular fibres passing up in this fold He suggests that the testicle in its descent pulls upon the cæcum by means of this fold and thus drags downward the cæcum to form a hernia of this type

- (b) Adhesions may be formed between the posterior surface of the cæcum and the peritoneum covering the yet undescended testicle (Carnett)<sup>6</sup> The cæcum will then be dragged down with the subsequent descent of the testis

The acquired condition is much the more common and is more comprehensible. Either there is a preliminary prolapse of the viscera on the posterior abdominal wall—in fact, a condition of enteroptosis, so that the cæcum lies at a lower level than normal and thus the retroperitoneal area lies in closer contact with the inguinal or femoral opening, and thus can easily prolapse through it—or, more commonly, a simple hernial sac is formed which enlarges, and, as it does so, drags down the peritoneum on the posterior abdominal wall. The cæcum, colon, and appendix, being firmly attached to this portion of peritoneum, are also dragged down and thus come to form the upper and posterior part of the sac.

That portion of the colon which in the abdomen was extra-peritoneal will therefore come to lie outside the sac wall, the condition being then exactly comparable with that of an extrasaccular hernia of the bladder, but, as would be expected, prolapse of the bladder is more common in femoral herniæ, that of the cæcum in the inguinal variety.

In the majority of cases the cæcal hernia is found on the right side, but at times it is present on the left side, Foerster<sup>10</sup> being able to collect 54 cases. In most of such cases the cæcum was intrasaccular, and, indeed, it would be difficult to see how an extrasaccular hernia could occur in this position unless a condition of situs inversus were present.

Many different degrees of this type of hernia may be seen, but they may all be grouped under the three following headings:

- (a) In this type there is a definite mesentery to the lower part of ascending colon, either of congenital origin or due to dragging upon the peritoneal attachments by the displaced cæcum. This mesen-

tery is attached to the posterior wall of the sac for a greater or lesser degree, thus reduction of the cæcum and colon becomes impossible unless the sac be reduced also. It will be seen that the branches of the ileocolic artery will enter between the two layers of this mesentery and thus will be running upon the posterior surface of the sac and therefore be liable to injury.

This variety, then, is characterized by the presence of a single piece of gut attached by a mesentery to the posterior wall (Fig 9)

- (b) In this variety there is no mesentery to the colon, this viscus having prolapsed through the ring while maintaining its normal extraperitoneal position, thus the sac will lie in front of the colon and only cover its anterior surface, the posterior surface of the viscus lying in direct contact with the posterior wall of the inguinal canal. The ileum, and generally the appendix, will maintain their normal peritoneal relationships, and thus will lie wholly within the sac, the relationships of the appendix depending upon its previous position with regard to the peritoneum while within the abdomen.

This variety, then, is characterized by the presence of a single piece of large gut which is only partly covered by peritoneum (Figs 10 and 11)

- (c) If the above condition continue to increase it will do so chiefly at the expense of the ascending colon. The mesenteric attachment of the lower part of the ileum appears to remain more or less fixed, so that the mesentery of the small gut has a relatively small attachment to the posterior wall of the sac. The ascending colon continuing to descend while the cæcum remains more or less fixed, a U-shaped

loop is formed which is composed wholly of large gut. According to Tuffier,<sup>37</sup> this condition may arise by the cæcum and colon descending to such an extent within the abdomen that the posterior surface of the colon comes to lie over the hernial orifice, and is thus the first structure to escape from the abdomen. It will be seen that the whole of this loop may be extrasaccular, or the cæcum may retain its normal relationships and thus lie within the sac covered by peritoneum, the colon alone lying without the sac.

The third type, then, is characterized by the presence of a U-shaped loop of large gut in part or wholly extrasaccular (Figs. 12 and 13)

III *Sacless Hernia*—This condition is very rare, and the explanation of the presence of the large intestine from the pull of a large sac would give no reason to believe that such a condition could occur. Sir F. Treves<sup>35</sup> even went so far as to state that a sac was always present. Cases, however, do undoubtedly occur in which there is no trace of a sac. One recorded by Tuffier<sup>36</sup> has already been mentioned, and Carnett<sup>6</sup> records another in which complete absence of any sac was made manifest by exploratory laparotomy. The description of Tuffier given above, that the primary condition is a prolapse of the cæcum and ascending colon, gives, however, a ready explanation of the occasional presence of such a lesion.

Ransohoff<sup>29</sup> has quite recently put forward an entirely new conception as to the cause of this type of hernia. He disagrees with the belief that the condition is due to sliding of the gut and posterior layer of the peritoneum. He believes that at first there is always a complete sac, and that the gut has become bound down by secondary adhesions which are similar to the adhesions, already described, which normally take place in embryonic life between the cæcum and the peritoneum of the posterior abdominal wall. Upon the amount of adhesions depends the size of the sac, if excessive, the sac may even be

obliterated. The proofs he brings forward seem, however, to be very incomplete. He believes that the condition cannot be due to sliding, because "even in the opened abdomen it is no easy task to strip the peritoneum from the abdominal wall, so close is its adherence, a statement with which I venture to think very few surgeons would be in agreement, while his remark that "a loop of intestine found in a hernial sac is conclusive proof that originally that loop was mobile" is simply arguing in a circle. His theory cannot, I think, be accepted, for the following reasons

- (a) It gives no explanation of the presence of the bladder in an extrasaccular position
- (b) In accordance with his views, most cases should occur in the young, while all observers are agreed that the condition is more common over the age of 30, the few cases occurring in children being readily explained by Lockwood's views
- (c) If his view were correct, it should be possible to make out the layer of sac behind the adherent cæcum or colon, while all are agreed that no such layer can be discerned

*Symptoms*—These are even less well defined than in the case of a hernia of the bladder, in fact, in nearly all cases the diagnosis is only made at operation. In the case of a simple hernia of the cæcum there will be nothing characteristic unless the appendix can be felt within the sac, as may sometimes happen in children. The presence of acute inflammation in such a displaced appendix has already been noted. In the other two types suspicion should always be aroused if there be a large hernia of long standing which is in part irreducible. It may be possible to distinguish it from a hernia of the bladder, apart from the presence of urinary symptoms in the latter, if the irreducible portion is noticed to lie to the outer side of the reducible part, the reverse being true in the case of the bladder. Owing to the wide neck strangulation is very rare

At operation the same difficulties in diagnosis will arise as in the case of the bladder, but here the gut will lie posterior and to the outer side. For this reason it is very easy to open into the lumen of the gut instead of into the sac. Great care should, therefore, be exercised in actually opening the sac in all cases. As a general rule, the presence of some abnormality is made clear by the presence of a mass of fatty muscular tissue within the inguinal canal, which differs considerably from the peritoneum of the ordinary hernial sac. When once the sac is opened the condition is made clear either by the presence of a portion of large gut which is seen to be firmly adherent to the posterior wall of the sac and thus to be irreducible, or by the fact that a thick mass can be felt forming the posterior and outer wall of the upper part of the sac.

*Treatment*—If there be a simple hernia, the gut can be reduced in a manner identical with that of the small gut and the sac closed in the usual way. If the gut be fixed to the sac by its mesentery or be in part extrasaccular, the operation already described will be found to answer admirably. In such cases care must be taken to separate the vas and spermatic vessels so that the testicle be not injured. In all cases sufficiently wide flaps of sac should be taken so that when folded back the gut is not constricted. When a U-shaped loop of gut is present these flaps should be specially large, so that when brought together there is no resulting angulation of the loop, and both in turning the gut forward and in suturing the flaps together, special care should be taken that the vessels supplying the gut are not injured.

The operation of re-forming a mesentery from the posterior wall of the sac was, as far as I can discover, first devised by Van Heuverswyn<sup>38</sup> in 1893, the sac being then dealt with in the usual way. A similar method has at different times been subsequently advocated by Berger,<sup>2</sup> Morris,<sup>25</sup> Tuffier,<sup>37</sup> Hotchkiss,<sup>13</sup> Wier,<sup>39</sup> and Singley.<sup>32</sup> In the method which I advocate, however, not only are the cæcum and ascending colon freed so that they can be easily reduced within the abdomen, but, the sac being firmly drawn up by the method devised by



Kocher,<sup>16</sup> the opening is entirely obliterated and the ascending colon tends to be drawn up away from the abdominal ring

In all cases the abdominal wall must be firmly repaired. In most cases it is sufficient to suture the conjoint tendon over the cord to the deep surface of Poupart's ligament. If, however, the wall be weak, the method of implanting two filigrees of silver wire devised by McGavin<sup>22</sup> for this region may be made use of, or, if the hernia be direct, the method of transplanting the rectus, put forward by Bloodgood,<sup>4</sup> may be tried

*Hernia of the Iliac or Pelvic Colon*—This condition may occur on either side of the body, but, as is to be expected, is more common on the left side. As in the case of the cæcum, it may be simple in nature or the gut may show close relationships to the sac wall. The former will alone be found on the right side of the body, a loop of the pelvic colon being readily able to escape into the sac of a right inguinal or femoral hernia, provided it has a sufficiently long mesentery. The true sliding hernia will be limited to the left side of the body

Anderson<sup>1</sup> was the first to show that the iliac colon may have its length and bend so increased that it passes down to Poupart's ligament, along the whole length of which it may run. In this position the peritoneum, which normally only covers the iliac colon in front, may be directly reflected off the bowel onto the anterior abdominal wall so as to leave a portion of the gut uncovered by peritoneum and in direct relationship with the posterior wall of the inguinal canal. In connection with this anatomical fact, Stoney<sup>24</sup> showed that in cases of sliding hernia the gut present was more commonly the iliac colon. The presence of the pelvic colon is common in such cases, but since this portion of the gut is usually provided with a long mesentery the loop is generally unattached to the sac wall, although, as will be shown, the mesentery itself may at times be so attached

As in the case of a hernia of the cæcum, the causes of a true sliding hernia may be congenital or acquired. The congenital, as Lockwood<sup>17</sup> points out, will arise in one of the two ways which lead to the formation of the cæcal variety, the

, attachment of the gubeinaculum or testis in this case being to the iliac colon instead of to the cæcum.

In the acquired type, also, the factors at work are similar to those of the cæcum but owing to the more constant relationships of the peritoneum the methods of production are less variable. Thus there may be a preliminary prolapse of the attachments of the pelvic or iliac colon on the wall of the false pelvis, this being usually part of a general enteroptosis, or the sac may be formed in the first place and by its increase drag down the attachment of the pelvic or iliac colons until they come to lie within and arise from the wall of the sac.

The same three degrees will be recognized as in the last variety, but these degrees will be dependent not upon variations in the attachment of the peritoneum, for in this part of the gut these are much more constant, but upon the portion of the gut which happens to be in the sac. They may be considered as follows.

- (a) With a definite mesentery—in this case the portion of gut lying within the sac is the pelvic colon. Thus there is a definite mesentery to the gut, but the attachment of this mesentery to the pelvic wall is displaced so that it comes to form part of the sac wall. The mesenteric attachment of the colon must, of necessity, be more or less U-shaped, for the prolapsed gut must form a loop, there being no free projection corresponding to the cæcum (Fig 14). Such a case was reported by Lockwood<sup>17</sup> where the loop of gut measured two feet and was formed of pelvic colon.
- (b) In the second variety there is a single piece of large gut which is extrasaccular, this, of necessity, being formed by the iliac colon, the method of attaining this position being identical with that of the cæcum. It will be seen, however, that there must in this case also be a returning portion of gut. This will be formed of pelvic colon and will have a definite mesentery, which is attached to the

sac wall It therefore occurs when the displacement takes place at the junction of the iliac and pelvic colons It corresponds with the second degree of that of the cæcum, but differs from it in that it shows the returning portion attached by a mesentery (Fig 15) Such a case has been recorded by Robinson<sup>30</sup>

- (c) In this variety there will be a loop of gut which will be extrasaccular in its whole length It will occur, therefore, when that portion which is displaced is wholly formed of iliac colon This was the type of case described by Stoney,<sup>34</sup> and further examples have been recorded by Robinson<sup>30</sup> It corresponds with the third degree of that of the cæcum (Fig 13)

It is possible that a sacless hernia might arise here also from a primary prolapse of the iliac colon, so that the posterior surface uncovered by peritoneum comes to lie over the internal inguinal ring and thus is alone prolapsed It will be seen, however, that as the condition increased the peritoneum covering the anterior surface of the gut would also pass outward, and thus a sac would come to be formed A true sacless hernia, therefore, could only exist in the early stages when symptoms would be slight or absent It is probably owing to this that there appears to be no such case reported in the literature

*Symptoms*—These will be as indefinite as those of the cæcum, but, as in that case, the presence of a large hernia in part irreducible should give rise to the suspicion that such a condition is present The presence of a large ring is also suggestive Usually the condition is only diagnosed at operation

*Treatment*—The simple types can be easily reduced in the ordinary way In the other types treatment will be more difficult, and Rankin<sup>28</sup> even goes so far as to state that the condition is inoperable This, however, is far from being the case, and the method of re-forming the mesentery and sac with invagination of the latter will be found to be simple and to answer

admirably In all cases care must be taken to thoroughly strengthen the abdominal wall by one of the methods mentioned in the case of the cæcum

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# AN INSTRUMENT FOR ESTABLISHING FECAL DRAINAGE, WITH A REPORT OF ITS USE ON A CASE, AND A CONSIDERATION OF THE SITE FOR MAKING A FECAL FISTULA IN LOW-SEATED INTESTINAL OBSTRUCTION.\*

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THE parts of the instrument are shown in Fig. 1. A scale drawing of a vertical mesial section, the natural size, is given in Fig. 2.

The particular use for which the instrument was designed is for the establishment of a fecal fistula, but it can also be used to allow the escape of wind from a clamped-off colon in the establishment of an artificial anus. In the latter instance it would probably be best not to make the joint connection with the bowel quite so tight as for fecal fistula, with a view of retarding the separation of the slough.

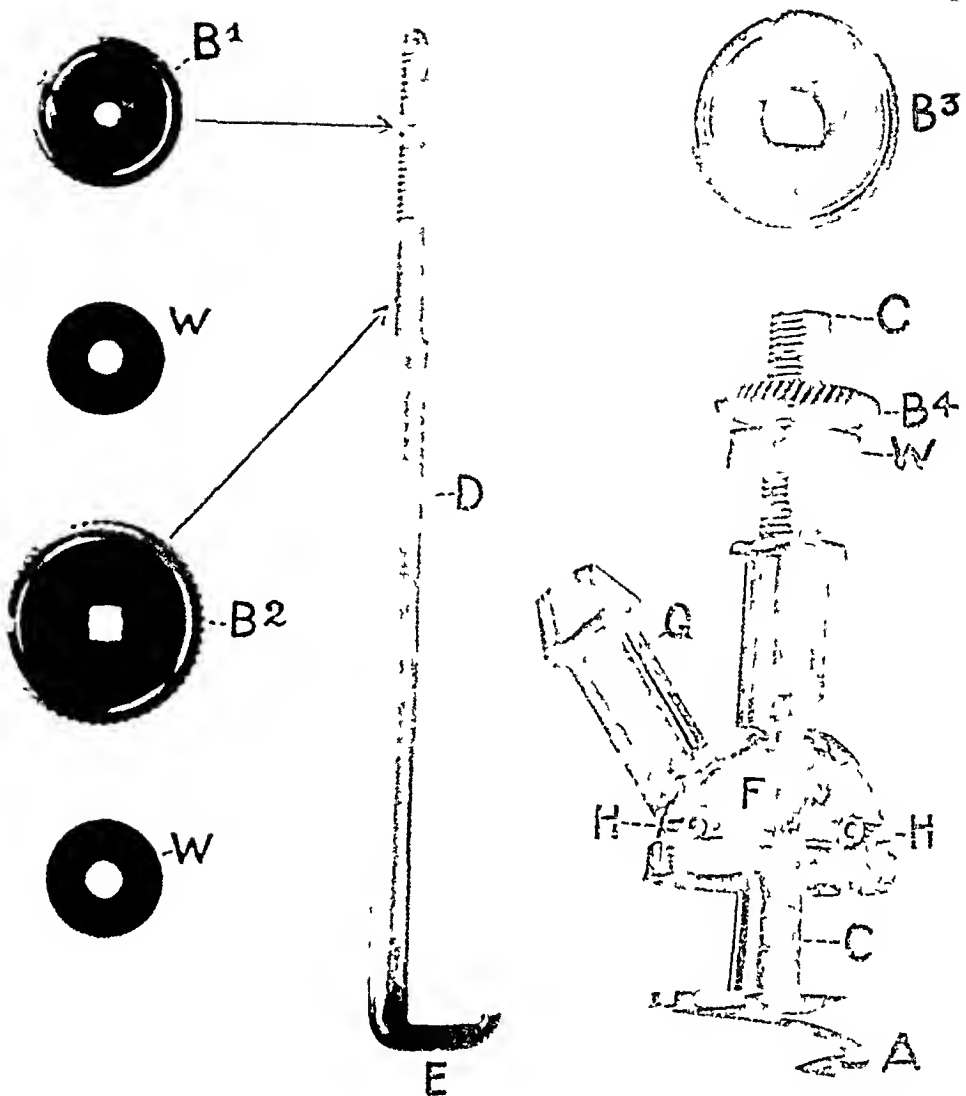
The principle employed in the construction of the instrument consists in the mechanical compression of the whole thickness of the bowel wall in a circle around a perforation in the bowel, between a ring introduced within the bowel and a cap closing over the ring from without, which maintains a water-tight joint around the perforation a sufficient length of time for protecting adhesions to take place between the bowel outside the area grasped by the instrument and the abdominal wall, before the instrument cuts through the tissues it compresses. This mechanical device does away with suture of the intestine to the abdominal wall, the bowel being held in position instead by tying the instrument grasping it, into the wound.

The instrument has been tested in five normal dogs and in

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FIG 1



Shows the several parts of the fistula instrument 4, as here seen is a corkscrew spiral connected by a binding post (P Fig 3 b) with a central stem C which is hollow for the passage of the shaft D. The spiral can be transformed into a complete ring or wheel by elevating its downward-dipping extremity which is a spring of tempered steel. The opening and shutting of this spring is regulated by the right-angled arm E of the shaft D the revolving of which latter is effected by button 2 (B 2) which fits over a square cut portion of the shaft and the elevation and descent of which is regulated by button (B 1), which turns on a thread. With the spring open the arm E being set opposite the binding post (Fig 3 a), the then spiral is passed, with a rotatory turn, within the lumen of the bowel through a small perforation as far as to the corner where the spiral and the binding post join together, after which the perforation is made to round the corner and is then slid along the binding post onto the central stem (see legend of Fig 5). Finally with the manipulating apparatus outside, the spring is closed, converting the spiral into a complete ring (Fig 3 b) against which within the bowel the cap F outside can then be made to evenly compress the intervening tissues, thereby forming a temporarily water-tight joint around the perforation. The cap F is screwed tightly in place by button 4 (B 4). Button 3 (B 3) is fixed to the central stem C and serves as a holder. The rubber washers W stopper the joints of the instrument and a rubber tube interrupted with a glass connection connecting with the pipe (G) projecting from the cap, provides the outlet for the drainage from the bowel. H, H loop-holes of which there are four for anchoring the instrument to the abdominal wall after it has been made to grasp the bowel.



THE CASE—The patient, a male, weighing about 225 pounds, was admitted to St Vincent's Hospital on September 20, 1911, to the service of Dr Edward L. Keyes, Jr, having fallen 30 feet and sustained an injury to the pelvis. On the fourth day a fecal fistula for the relief of intestinal obstruction was established as follows. Chloroform and oxygen anæsthesia was administered by Dr Gwathmey. The incision was made through the outer fibres of the right rectus muscle, the skin cut beginning at the level of the umbilicus and extending downward about  $3\frac{1}{2}$  inches, while the opening through the abdominal wall, placed centrally within the skin cut, was about 1 inch in length. The presenting piece of bowel could not be displaced and an adjoining loop substituted for it, so fixed in their positions were the distended coils. It had been planned at this juncture to include a sufficient area of a distended piece of bowel within the grasp of two curved intestinal clamps having thin spring blades protected with rubber, and draw it outside the abdominal wall while the fistula connecting-joint was being adjusted in position, but this was found impossible to carry out owing to the shortness of the mesenteric tether, which barely allowed the gut to be drawn sufficiently far into the abdominal wound to work on. The two intestinal clamps were at the start applied to the presenting piece of bowel, but the included area was so small that one clamp had to be removed. There was some little escape of gas during the introduction of the spiral, but there was a much greater escape of gas through the tube attached to the fistula connecting-joint after the latter was in place. There was not sufficient room in this wound to introduce gauze for the protection of the peritoneal cavity, but there was essentially no escape of intestinal contents. The cap was screwed down as firmly as possible against the ring, thus compressing the bowel around the perforation. Silkworm-gut sutures were inserted to attach the four loop-holes of the cap to the edges of the cut in the anterior portion of the rectus sheath, before tying which a narrow collar of iodoform gauze was placed beneath them around the line of juncture of the instrument with the bowel, for drainage. After tying the silkworm-gut sutures the ends were left long, protruding through the wound, so that they could easily be found for subsequent removal, and the wound was then filled with iodoform gauze.

*Subsequent Course*—There was immediate and complete re-



this, the placing of a gauze collar around the base of the instrument (Figs 6 and 7) was introduced into the technic of the operation, and then no sepsis occurred

In the first three dogs and in the patient the abdominal incision was a transrectus one, and the loop-holes of the cap were tied to the margins of the cut in the anterior layer of the rectus sheath. In the last two dogs the incision was transverse, dividing the linea semilunaris and the abdominal wall external thereto, the loop-holes of the cap were tied to the outer surface of the external oblique muscle at points about 1 cm from its

FIG 3a

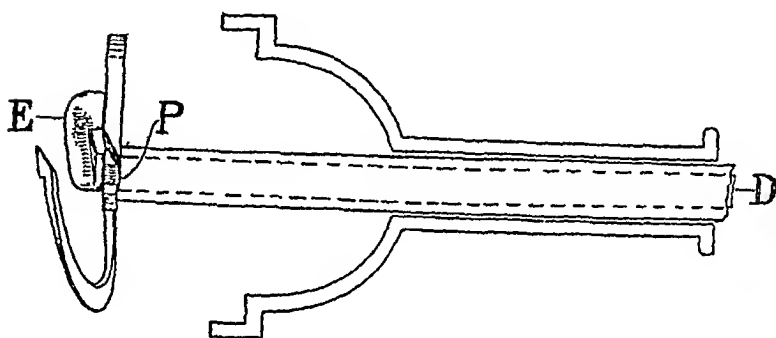


FIG 3b

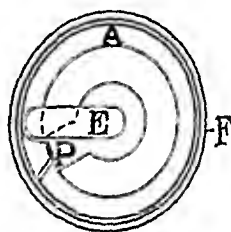


Fig 3 a shows the adjustment of the instrument preparatory to use. The cap is slid up on the stem. The spring is open and the right-angled arm E of the shaft D is set opposite the binding post P where it is secured firmly in position by turning up tight button 1 (Figs 1 and 2). Buttons 2 and 3 are properly notched, so that when the two notches lie opposite each other the arm E underlies the binding post. The instrument, during the introduction of the spiral, should be held with its long axis approaching the horizontal position (*cf* Fig 5).

Fig 3 b, drawn to a scale the natural size, shows the base of the instrument with the spring closed, the spiral thus having been converted into the ring, which closure should be made after the complete passage of the spiral through the perforation to within the lumen of the bowel. To effect closure of the open spring, the right-angled arm E of the central shaft, after having been loosened from its position of fixation described under Fig 3 a, is rotated by turning button 2 (Figs 1 and 2) from left to right until it encounters the notch near the tip of the spring, and then, by screwing button 1 up tightly, the spring is rused into the position of completing the circle. If the rubber washer beneath button 1 is dry it will oppose great friction to turning this button as the grip of the latter tightens. The friction can be overcome by a drop of oil.

cut edges, and the deep portion of the muscular opening was narrowed around the extruded bowel, as recommended herewith. In the fourth dog, while under ether just before being killed two days after the operation, it was found that the muscle-fibres of the abdominal wall maintained a loose closure of the fistulous opening. The finger inserted through the fistula was felt to dilate slightly the opening in the abdominal wall, and, as it was withdrawn, a lot of fluid escaped from the intestine, which before had apparently been retained by a sphincter-like action of the encircling muscle fibres. The specimen pictured in Fig 7 was from the fifth dog.

THE CASE —The patient, a male, weighing about 225 pounds, was admitted to St Vincent's Hospital on September 20, 1911, to the service of Dr Edward L. Keyes, Jr, having fallen 30 feet and sustained an injury to the pelvis. On the fourth day a fecal fistula for the relief of intestinal obstruction was established as follows. Chloroform and oxygen anæsthesia was administered by Dr Gwathmey. The incision was made through the outer fibres of the right rectus muscle, the skin cut beginning at the level of the umbilicus and extending downward about  $3\frac{1}{2}$  inches, while the opening through the abdominal wall, placed centrally within the skin cut, was about 1 inch in length. The presenting piece of bowel could not be displaced and an adjoining loop substituted for it, so fixed in their positions were the distended coils. It had been planned at this juncture to include a sufficient area of a distended piece of bowel within the grasp of two curved intestinal clamps having thin spring blades protected with rubber, and draw it outside the abdominal wall while the fistula connecting-joint was being adjusted in position, but this was found impossible to carry out owing to the shortness of the mesenteric tether, which barely allowed the gut to be drawn sufficiently far into the abdominal wound to work on. The two intestinal clamps were at the start applied to the presenting piece of bowel, but the included area was so small that one clamp had to be removed. There was some little escape of gas during the introduction of the spiral, but there was a much greater escape of gas through the tube attached to the fistula connecting-joint after the latter was in place. There was not sufficient room in this wound to introduce gauze for the protection of the peritoneal cavity, but there was essentially no escape of intestinal contents. The cap was screwed down as firmly as possible against the ring, thus compressing the bowel around the perforation. Silkworm-gut sutures were inserted to attach the four loop-holes of the cap to the edges of the cut in the anterior portion of the rectus sheath, before tying which a narrow collar of iodoform gauze was placed beneath them around the line of juncture of the instrument with the bowel, for drainage. After tying the silkworm-gut sutures the ends were left long, protruding through the wound, so that they could easily be found for subsequent removal, and the wound was then filled with iodoform gauze.

*Subsequent Course* —There was immediate and complete re-

lief to the distention. The patient lived 22 hours following the operation. About 15 hours after the operation about 1 pint of intestinal contents dropped freely from the tube, at which time it was noted that the abdomen had become considerably distended again. Eighteen hours after the operation the patient was fully distended again and vomiting. The instrument was then evidently obstructed, as fluid could not be forced back through the rubber tube into the intestine. The rubber tube was cut off 2 or 3 inches from the instrument and then, by the injection of olive oil and probing with a paracentesis tympani knife, the obstruction at the site of the fistula was apparently overcome. The pieces of the tube were joined together again by a glass connection. Small quantities of fluid injected through the tube would return, yet practically no gas escaped any longer, to test which latter the free end of the drainage tube was put under water.

*Post Mortem* — Within the circle of compression there was a slough which had not cut through, so that no intestinal leakage had occurred into the abdominal wound. There was a firm adhesion of the bowel around the fistulous opening to the abdominal wall. There was no peritonitis. The iodoform gauze collar was firmly adherent. On one side the collar had gotten pushed well down alongside the bowel, so that it prevented so extensive an adhesion to the abdominal wall on this side as was present on the other. A little more than half the lumen of the bowel was taken up by the fistula and its peripheral adhesions. The instrument used, however, was an early model, having a cap the base of which measured one inch in diameter. The site in the bowel where the fistula was made was found to be about 12 feet from the ileocæcal valve. The lower ileum was found to occupy the region in front of the ascending colon. The sigmoid flexure dipped horseshoe-shaped from two sites of fixation at the brim down into the pelvic cavity, which it filled so snugly that it was pulled out with the overcoming of considerable suction. An angulation here seemed to have been the cause of the obstruction. The pelvic cavity was very much narrowed with fat, and the sigmoid loop was fatty. There was a diastasis of the pubic bones of about  $2\frac{1}{2}$  inches, and the soft parts were stripped from these bones both in front and behind. In the cavity that had formed at this situation there was collected about 6 to 8 ounces of bloody fluid. There was no infiltration around either kidney.

*Other Notes from History*—A catheter tied in the patient's bladder on admission had, at the beginning, drained a few ounces of bloody urine, and then anuria supervened. Later a small quantity of urine could be withdrawn. On the fourth day a perineal and scrotal extravasation of urine developed, which subsided with incision. During the third and fourth days the temperature had been around  $98\frac{1}{2}^{\circ}$  most of the time.

*Observations*—It is of interest that an apparently correctly made fecal fistula which had been patulous for at least 15 hours, had not, after the primary relief, been affording adequate drainage of the bowel, since at the expiration of this time distention had begun to recur, and also that after another three hours, when an obstruction which had in the meantime occurred at the site of the fistula was relieved, no further escape of gas took place. In trying to account for this result it has seemed possible that an angulation of the bowel might have occurred at the site of fistula formation, or, in view of the fact that the fistulous opening was situated about 12 feet along the gut above the ileocaecal valve, it might be explained on physiological grounds, that, in order to get effectual drainage of a distended small intestine, it may be necessary to tap the latter near the ileocaecal valve. Moynihan<sup>1</sup> calls attention to the fact that "fluid taken by the mouth speedily excites a wave of peristaltic activity in the lowest ileum." He continues, "In cases of typhlotomy or of enterostomy, in which the caecum or lowest ileum is opened, it can constantly be observed that the drinking of a little fluid excites a considerable disturbance in this region." For the latter reason, as well as in the interest of establishing the fistula at a situation which would allow the best nourishment of the patient, a study was made on the cadaver to determine an incision through the abdominal wall which would with greatest invariability expose a piece of gut in the ileocaecal region in the presence of low-seated intestinal obstruction.

The physical conditions attendant upon intestinal obstruction are so vastly different from the normal that a proper technic of joining the fistula instrument with the intestine in

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<sup>1</sup> Moynihan. Acute Emergencies of Abdominal Disease, Brit. Med.

the obstructed condition had also to be made the subject of special study. The complicating circumstance in connecting the fistula instrument with the bowel in a case of intestinal obstruction is, that in great abdominal distention the intestines next the abdominal wall in the lower right quadrant of the peritoneal cavity generally lie at the limit of their mesenteric tether, so that the piece of bowel presenting at a wound in the abdominal wall within this area cannot be drawn outside of the peritoneal cavity for manipulation. Slack in the bowel can be gained only by getting the abdominal wall to retract, and this, in turn, can be attained only by the elimination of gas from the distended intestines, so that the primary problem resolves itself into how to allow the escape of gas from a piece of distended intestine presenting in a small abdominal incision, which is immobilized flush with the parietal peritoneum both by a general intestinal distention and a limiting mesenteric attachment, without soiling the peritoneal cavity with intestinal contents.

These problems, as well as a proper technic of fixing the fistula instrument in the wound in the abdominal wall, were studied on cadavers.

CADAVER STUDIES FOR THE DETERMINATION OF AN ABDOMINAL INCISION WHICH WOULD WITH GREATEST INVARIABILITY EXPOSE A PIECE OF DISTENDED GUT IN NEAR CONTINUITY WITH THE ILEOCÆCAL VALVE, IN THE PRESENCE OF LOW-SEATED INTESTINAL OBSTRUCTION

Observations were made on 19 bodies. *Since in the patient the lower ileum had occupied exclusively the right flank, lying in front of the ascending colon, the course taken by the ileum from the ileocæcal valve was made a record of in each body.* For the determining of the abdominal incision it was necessary to inflate the intestines. Two conditions of distention were studied: one, that in which the cæcum took part in the general distention, and the other, that in which the cæcum was collapsed and small intestine only was distended. To study the former condition, the inflation was generally made through the transverse colon, while to study the latter the lower ileum was tied off and the inflation made through a piece of small intestine picked up from the left side of the pelvis.

*Two right-sided incisions in particular were made the object of study. Both were transverse, one opposite the junction of the outer with the middle thirds of Poupart's ligament, and the other opposite the most*

prominent portion of the anterior superior spine of the ilium. Both cut through the internal oblique and transversalis muscles in the course of their fibres. The midpoint of the former was about  $1\frac{1}{2}$  inches internal to Poupart's ligament, making an opening through which the most direct access to the lateral portion of the pelvic brim can be had. This incision generally lies below the level of a distended cæcum.

The higher incision first cuts the abdominal wall just external to the linea semilunaris and then cuts through the linea semilunaris, making an opening about  $1\frac{1}{2}$  inches in length (Fig 4). The linea semilunaris in the course of this incision generally corresponds to a point midway between the anterior superior spine of the ilium and the middle line of the abdomen. Its division allows the wound to gape to a considerably additional extent, and affords as well, to the exploring finger, an added reach in the direction of the brim and promontory. The inner extremity of this incision, in both distention and collapse of the abdomen, lies directly over the bony angle at the right side of the promontory, thus indicating a very direct route to the region of the ileocæcal valve and to the site of lowest attachment of the mesenteric root. This incision exposes a distended cæcum, unless the latter be situated abnormally high.

In the series of observations on the 19 cadavers, only those records of individual cases which it was thought might contribute information of interest to the subject are here given. In 13 of the cadavers the intestines were inflated. The first three of these inflation tests were made on opened bellies to seek for variability in the position of the lower ileum in the presence of general intestinal distention. Ten inflation tests were made on closed bellies for the study of abdominal incisions in relation to the presenting pieces of distended intestine. From the latter studies it was determined that a distended cæcum would generally present in the higher of the two transverse incisions, but not in the lower. Of particular practical interest in this series were the observations made in the presence of inflated small intestines alone, the colon being collapsed (subjects *d*, *e*, *f*, *g*, and *h*). In six of the cadavers, simply the location of the lower ileum within the peritoneal cavity was noted, without inflation.

The following three cases are those on which the inflation tests were made on opened bellies the intestines of which had undergone previous manipulation.

(a) Thin male. Pelvis roomy. The lower ileum was first deposited in the pelvic cavity, and then the intestines were inflated through the sigmoid flexure. With the inflation, the lower ileum rose out of the pelvis and took a position in the right flank to the inner side of the cæcum and in front of the ascending colon, while some of the mid-loops of small intestine slid down into the pelvic cavity to take its place. The lowest loop of ileum that lay in the pelvic cavity was about 8 feet above the ileocæcal valve. It was estimated that a loop of ileum about  $2\frac{1}{2}$  feet above the ileocæcal valve about corresponded to a mid-point between the 10th costal cartilage and the anterior superior spine of the ilium.

(b) Fat male. Pelvis roomy. From the ileocæcal valve the ileum passed directly into the pelvic cavity. The 4 inches of ileum adjoining the ileocæcal valve were bound firmly down across the psoas muscle.

Intestines distended through transverse colon. A loop of small intestine lying in front of the distended cæcum, about corresponding to the site of the incision in the patient, was about 7 feet above the ileocæcal valve. A loop picked up just above the pubis a little to the right of the median line had about 3 feet of intestine intervening between it and the ileocæcal valve.

(c) Thin male. Pelvis roomy. The ileum descended from the ileocæcal valve into the pelvic cavity. Its four inches nearest the cæcum were attached by a very short mesentery, which allowed this segment very little mobility. The cæcum was free and distended tremendously. The loop of ileum lying just internal to the distended cæcum, opposite the ileocæcal valve, had about 4 feet of intestine intervening between it and the latter.

The following observations on the relations of the two transverse abdominal incisions to the distended small intestines were made. In cadavers *g* and *h* the relations of the distended bowel to the lower transverse incision were not recorded. It is distinctly remembered, however, that in these bodies the lower incision offered no advantage over the upper, and all the preference was in favor of the latter. In cadaver *i* both large and small gut were inflated.

(d) With the lowest ileum, which here passed from the ileocæcal valve directly down into the pelvic cavity, tied in its terminal portion, and the small intestine inflated, the loop that presented in the transverse incision opposite the anterior superior iliac spine was about 2 feet from the ileocæcal valve.

(e) The lowest  $1\frac{1}{2}$  feet of ileum had a short mesentery and lay in the right iliac fossa below a high-seated cæcum. The next higher piece of ileum formed a loop dipping into the pelvic cavity and then ascended into the right flank. The ileum was tied about  $1\frac{1}{2}$  feet from the ileocæcal valve, and, after inflation, the piece of small intestine that presented in the transverse incision opposite the anterior superior iliac spine was about 1 foot above the site of ligature. In the transverse incision opposite the junction of the outer with the middle thirds of Poupart's ligament, the loop that presented was continuous with that found in the upper incision.

(f) The ileum was tied very near the ileocæcal valve. With inflation of the small intestines, two pieces of distended gut presented in the transverse wound opposite the anterior superior iliac spine, the internal of which was about 5 inches and the external of which was about 15 inches from the seat of ligature of the ileum. The external of these pieces was directly continuous with the piece of bowel that presented in the transverse wound opposite the junction of the outer with the middle thirds of Poupart's ligament. A third piece of distended gut lying in the iliac fossa external to the abdominal incisions was about  $4\frac{1}{2}$  feet above the seat of ligature, showing that the piece of intestine farthest to the right in the pelvis is not necessarily the piece in closest continuity with the ileocæcal valve. In distention the lowest ileum passed over the brim to the right of the promontory, and then went diagonally across the pelvis to the left, lying superficial to the mesenteric root descending from above the promontory into the pelvic cavity. In this cadaver the distention held very tight and afforded an excellent opportunity to palpate the mesentery.

took a direct route between the two presenting coils down to the brim, and, following the latter inward, could palpate a transverse mesentery, here tense, attached between the spinal column and the ileocæcal valve, which was associated with the piece of gut presenting at the inner part of the wound, distinguishing the same as being near the ileocæcal valve

(g) Before inflation the lower ileum was situated entirely above the brim. The ileum was tied about 6 inches above the ileocæcal valve. With inflation the lowest ileum descended into the pelvic cavity, forming a short loop over the brim. Two distended pieces of bowel presented about equally in the upper and lower halves of the transverse incision opposite the anterior superior iliac spine. The finger could be insinuated between these two coils directly to the brim, palpation along which toward the promontory distinguished a transverse mesenteric attachment between the spinal column and the ileocæcal valve in near association with the lower presenting piece of bowel, which would seem to indicate nearness of such piece of bowel to the ileocæcal valve, as was here found to be the case. The lower piece of presenting bowel was found to be about 10 inches and the upper piece about 3 feet from the ileocæcal valve.

(h) The lowest ileum passed into the pelvic cavity. It was tied about 4 inches from the ileocæcal valve and the small intestines were inflated. The lower  $4\frac{1}{2}$  feet of the ileum were found collapsed in the right side of the pelvic cavity and the first inflated loop adjoining the collapsed portion rose directly out of the pelvic cavity and presented in the transverse wound opposite the anterior superior iliac spine. The presenting piece of intestine was about 1 foot above the collapsed portion.

(i) Very fat female. Before inflating the intestine it was observed that the lowest 3 feet of ileum formed a loop upward into the region of the cæcum and ascending colon. The next higher portion of the ileum occupied the lower right iliac region and pelvic cavity. Distention effected through colon. At the inner angle of the transverse wound opposite the anterior superior iliac spine, there presented alongside the distended cæcum a piece of small intestine which was about 5 feet above the ileocæcal valve.

*Variations in the Anatomic Arrangement of the Lower Ileum*—Out of the 19 cadavers studied, the distended lower ileum occupied exclusively the right flank in one instance (subject *a*). The conditions in this cadaver, however, were not exactly similar to those existing in the patient, since in the former the belly had been widely opened before inflation, yet, since the arrangement of the coils in distention is probably influenced chiefly by the conformation of the mesentery, it would seem fair to include both these subjects in the same class. Once (subject *i*) the lowest 3 feet of ileum formed a loop, ascending into the region of the cæcum and ascending colon before the bowel descended into the pelvic cavity, and again the lowest 1 foot of ileum did the same. In three instances



(including subject *e*) the ileum passing from the ileocæcal valve formed a loop in the right iliac fossa before descending into the pelvic cavity. In two instances (including subject *f*) the lowest ileum passed from the ileocæcal valve diagonally across the pelvis downward and to the left above the brim, while the loops farthest to the right in the iliac fossæ were respectively about  $4\frac{1}{2}$  and (probably) about 7 feet above their ileocæcal valves. In eleven instances the lowest ileum passed over the brim directly into the pelvic cavity.

*The Immobility of Distended Intestines*—In the intestinal distention produced on the cadavers, the loops of small intestine in the right iliac region were generally found in contact with the parietal peritoneum at the limit of their mesenteric tether, so that the presenting piece of gut could not be drawn outside of the peritoneal cavity, and were so tightly wedged together that the loop presenting in the wound could not be displaced and an adjoining one substituted for it. With the finger the mesentery could be felt to be taut, and it seemed as though a considerable traction on the same must be an accompaniment of great abdominal distention.

*Palpation of the Mesenteric Attachments through the Incision Opposite the Anterior Superior Iliac Spine*—In the case of a distended cæcum, palpation within the peritoneal cavity is of use only in determining whether this piece of bowel be free or attached. With, however, the colon collapsed and small intestine presenting in the wound, it would be helpful if by palpation an estimate of the probable length of bowel intervening between the presenting piece of intestine and the ileocæcal valve could be formed. The writer would propose the *pelvic brim* as the location first to be sought for by the exploring finger. Here a piece of lower ileum passing from the neighborhood of the ileocæcal valve into the pelvic cavity, usually at a site just to the right of the promontory, can be detected, or, when this piece of bowel rather lies forward in the pelvic cavity, it may be identified by pushing the finger upward from the brim and feeling its mesentery attached transversely between the spinal column and the ileocæcal valve. In order to reach the brim the finger must pass beneath, or

external to, any intervening mesentery. In cases where the lowest ileum descends into the pelvic cavity, when the finger can be passed external to the presenting piece of bowel in a very direct line to the brim, that piece of bowel is likely in near continuity with the ileocæcal valve (*cf* subject *f*). In palpating, the greatest reach in an inward direction can be gotten by the middle finger with hand supine.

*The advantages of the transverse incision opposite the anterior superior iliac spine, as a primary choice, over that opposite the junction of the outer and middle thirds of Poupart's ligament*

1 If the obstruction is in the large intestine, the former incision will expose the distended cæcum, unless the latter be situated abnormally high.

2 With small intestines alone distended after tying the terminal portion of the ileum in 4 cadavers, the pieces of bowel nearest the ileocæcal valve which presented in the higher incision were, respectively, 2 feet, 1 foot, 5 inches, and 4 inches (subjects *d*, *e*, *f*, and *g*) above the seat of ligature. These observations indicate but a general tendency for a very low piece of distended ileum to be in relation with the higher incision (*cf* subjects *a*, *b*, *h*, and *i*).

3 The higher incision is nearer the lowest site of attachment of the mesenteric root to the posterior parietes, so that the mesenteric tether of a piece of ileum presenting in this wound would be much more liable to allow a greater amount of extrusion of its attached bowel upon relief of the distention than would the mesentery of a piece of bowel presenting in the lower incision.

4 Palpation of the mesenteric attachments is more direct through the higher incision.

#### PROPOSED TECHNIC OF ESTABLISHING A FECAL FISTULA FOR THE RELIEF OF A LOW-SEATED INTESTINAL OBSTRUCTION WITH THE USE OF THE FISTULA CONNECTING-JOINT

Since the technic of establishing a fecal fistula for the relief of intestinal obstruction as here proposed has been

be based largely upon cadaver study, though carefully planned in accordance with surgical principles, it must yet receive the test of experience before it can be thoroughly approved. It can, however, be said in its favor that, with the use of this mechanical device which makes in a few minutes a water-tight drainage connection with the bowel around a small puncture, with no intestinal suturing, the operation would surely seem to be attended with much less danger of infecting the peritoneal cavity than has attended previous methods, that the operation can be more easily and rapidly performed than with any other technic, and that, with no added danger, relief from the intra-abdominal tension is gained at once.

The general technic of the operation as here proposed is indicated in the legends of Figs 3, 4, 5, and 6, while Fig 7 pictures the result attained by the operation performed on a normal dog. The following discussion of the technic of the operation amplifies the legends.

*The Holding-thread* —The principle of the holding-thread placed close to the site of puncture of the bowel, as a means of preventing soiling from intestinal contents, has been utilized by Coffey<sup>2</sup> in connection with opening the stomach. Coffey raises forward by holding-threads an anterior area of stomach wall for incision, thus causing the opposite portion to pouch dependently for the collection of the stomach contents, which are removed by means of a ladle and gauze wiping. In like manner here, the raising forward of the site of puncture should distance it from the level of the gravitated intestinal contents, thus allowing the escape of gas with a minimum of ooze.

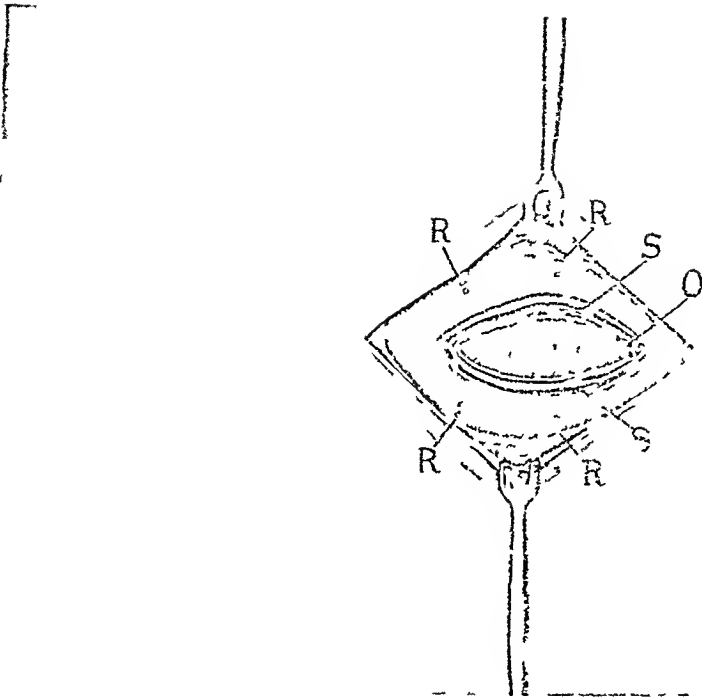
The holding-thread must be securely placed beyond any possibility of its tearing out, and therefore it would seem best that the needle placing it should pass through the interior of the bowel, making, of course, sure that this site of puncture be later included within the area encompassed by the compressing circle of the instrument.

The holding-thread should likewise catch the presenting

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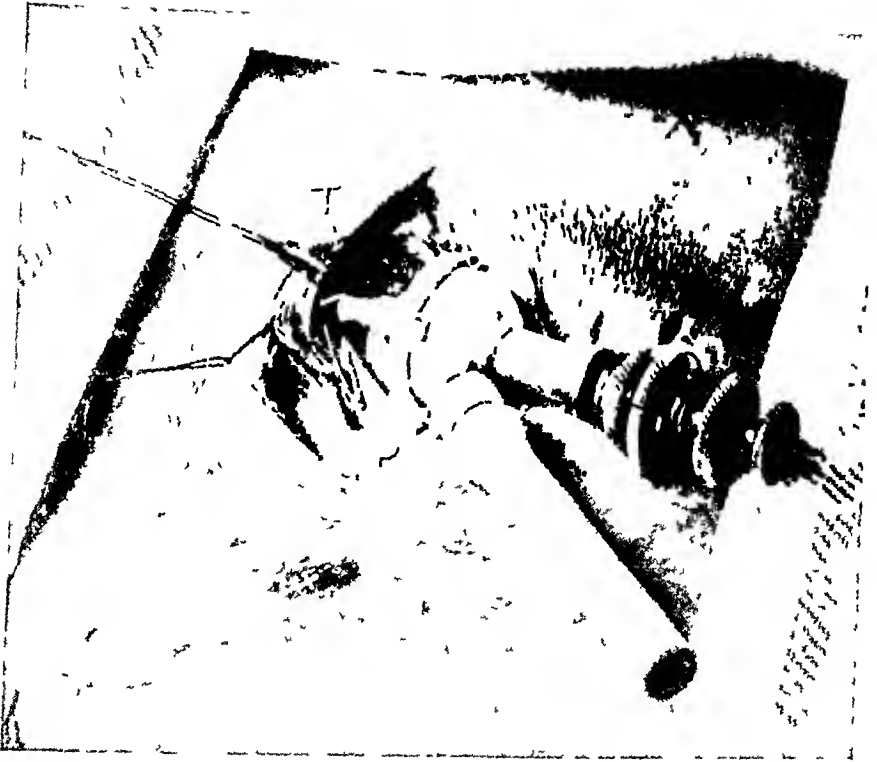
<sup>2</sup> Coffey Jour Amer Med Assn, lvii, 1911, p 1034

FIG. 4



Proposed incision of primary choice for the establishment of a fecal fistula in low seated intestinal obstruction (see pp 113 and 119). The incision is one across the right iliac fossa at a situation which will generally uncover a distended cæcum or if the obstruction is at or near the ileocæcal valve most probably a low loop of distended ileum. It is made in the transverse line between the anterior superior spines of the ilia and cuts through the abdominal wall on the right side, first just external to the linea semilunaris and then through the linea semilunaris making an opening in the abdominal wall about  $1\frac{1}{2}$  inches in length. The division of the linea semilunaris allows the wound to gape thus making as broad as possible an exposure of the bowel. The inner portion of this incision is situated directly over the bony angle of the brim at the right of the promontory lies in front of the normally situated ileocæcal valve and is in near relation with the site of lowest attachment of the mesenteric root. The dots indicate the sites for the sutures seen *in situ* in Fig. 6. *O* site at the inner angle of the wound of introducing the holding suture in a presenting distended cæcum bound down in the external portion of the iliac fossa which admits of the greatest amount of slack being drawn out of the peritoneal cavity centrally into the wound (see p. 119). With the cæcum bound down in the iliac fossa no slack bowel can be drawn inward from the outer angle of the wound, so that the holding stitch should then not catch the bowel at the latter situation. *R R R, R*, sites for the four silkworm-gut sutures anchoring the fistula instrument to the aponeurosis of the external oblique muscle about 1 cm from the edges of the cut. *S S* site of passing a catgut suture through the internal oblique and transversalis muscles and the parietal peritoneum to narrow this deep portion of the abdominal wound around the extruded bowel beneath the portion grasped by the instrument.

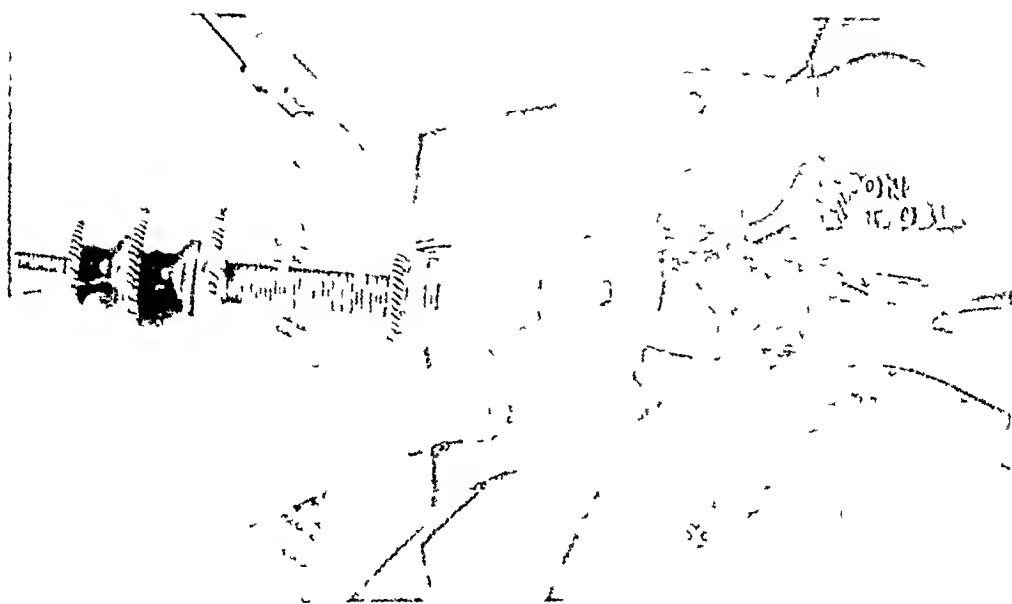
FIG 5



Fixation of the instrument in the bowel (planned from cadaver study) (see p 119). A gauze strip should, if possible, be placed so as to protect the peritoneal cavity from infection. A holding-thread is first made to catch deeply the presenting piece of bowel at a site which permits of slack being drawn into the wound (see p 118), and thereafter is held taut. A small opening about  $\frac{1}{4}$  inch in diameter is cut in the bowel near the thread. On the cadaver with puncture of the bowel gas is eliminated sufficiently to cause enough retraction of the abdominal wall so that the piece of bowel caught by the holding-thread can be drawn into the wound in a tent-like fold, which is the position of choice for the introduction of the spiral. With the instrument adjusted (Fig 3 a) for introduction of the spiral, the latter is now inserted through the opening by a corkscrew turn in the direction of the cleft between the slopes of the tent-like fold. Thus during this manipulation the shaft of the instrument approaches the horizontal position. In order that the free extremity of the spiral shall not catch on the bowel during its introduction, the rim of the introduced portion should be first pushed into the bowel in a direction away from the operator, following the bowel wall, and then sunk backward within the lumen of the gut. The contour caused by the contact of the rim of the introduced portion with the interior of the bowel.

When the spiral has been introduced up to the post (P) which binds it to the central stem, then the opening in the bowel is made to turn the corner and pass over the binding post onto the central stem, by pulling on the tissues which tend to gather at this situation into an obstructing fold in the direction of the arrow (see p 120). As the perforation in the gut rounds the corner the instrument is raised into the vertical position and, holding the bowel with the thread, the binding post is pushed within its lumen until the perforation encircles the central stem. The spring is now closed (Fig 3 b) the holding-thread is cut away, the instrument now serving as tractor, and the cap is brought down over the ring within the bowel so as to include the punctured areas and screwed firmly in place. A on anterior superior spine of ilium

FIG. 6



Plan of fixation of the bowel in the transverse abdominal wound (cf Fig 4 and sec p 121). No intestinal sutures are used. Instead after the incisions have been made to grasp the bowel the four loop-holes around the margin of the wound are bound by silkworm-gut sutures two on either side of the wound to the outer ends of the external oblique muscle at points about 1 cm from its cut edges. Before tying any of these sutures a collar of  $\frac{1}{4}$ -inch-wide folded iodoform gauze should be passed between them so as to encircle the base of the cap. Without a drain of this sort in the first dog test of the instrument a severe phlegmon of the abdominal wall resulted. Each two sutures fixing the instrument to the same side of the wound should grasp the aponeurosis at points a sufficient distance apart so that when they are tied the intervening aponeurosis will not be drawn snugly against the base of the cap since if the latter is done the gauze drain is then depressed between the bowel and the abdominal wall thus diminishing the extent of the adhesion in this situation (see Fig 7). Also before tying these fixation sutures a catgut stitch S grasping the internal oblique and transversalis muscles and the parietal peritoneum on either side of the wound narrows the latter around the extruded portion of the gut to a diameter less than that of the base of the cap. A collar of deep tissue of the abdominal wall is thus brought snugly and securely around the gut for adhesion throwing the area for fistula formation well outside of the peritoneal cavity. A second catgut stitch is inserted if necessary for closure of the peritoneal opening. The ends of the silkworm-gut sutures are left long to facilitate the subsequent removal of the sutures. X on anterior superior spine of the ilium.

FIG 7



Cross section of a dog specimen of a fecal fistula established by the use of the fistula instrument, removed 22 hours after operation and hardened before the instrument was cut free. The area included within the circle of compression had sloughed out. The notch *L* had received the flange (Fig 2), turned at a right angle around the margin of the base of the cap. The thin edge of tissue *M* forming the inner boundary of this notch corresponds to the site of separation of the slough at the outer limit of the circle of compression. The incision was a transverse one at the outer border of the right rectus muscle cutting the linea semilunaris. The four loop-holes around the base of the cap, after the instrument had been made to grasp the bowel had been anchored to the outer surface of the external oblique muscle on either side of the wound about 1 cm from its cut edges so that the bowel was drawn well into the abdominal wound. The wound through the internal oblique and transversalis muscles and the parietal peritoneum was at the same time narrowed rather closely around the protruded bowel so that this deeper portion of the abdominal wound is seen to have underlapped the base of the instrument thus causing the bowel to flare a little outside of the level of narrowing. Within the peritoneal cavity the bowel has also flared a little around the opening, so that an adhesion has taken place as well between peritoneal surfaces. The portion of the gauze drain *N* on the left side of the illustration is seen to lie between the bowel and the abdominal wall below the level of the compressing circle of the instrument thus diminishing the extent of the adhesion in this situation. The deep position of the drain on this side was due to the catching of the external oblique by the two fixation stitches of this side at points situated so closely together that there was no space for the gauze collar to ride up between them alongside of the instrument.

piece of bowel at a situation which will admit of the greatest possible amount of slack being drawn out of the peritoneal cavity centrally into the wound, so that, with the relief of intra-abdominal tension resulting from puncture of the bowel, the holding-stitch can both draw the site of puncture up to as great a height as possible outside of the peritoneal cavity, and at the same time form the tent-like fold (Fig 5) which accommodates the manipulations of installing the fistula instrument in place. In the case of a distended cæcum fixed to the outer portion of the iliac fossa, the greatest amount of slack can be secured by catching this bowel with the holding-thread at the inner angle of the transverse abdominal wound (Fig 4, O), since internally a cæcum thus attached is free and such holding-thread can, therefore, be made to pull its site of fixation in the bowel in an outward direction. On the other hand, a holding-thread catching such bowel at the outer angle of the wound would be unable to draw any slack inward, owing to the attachment of the intestine externally in the iliac fossa. In one cadaver, in which the lower extremity of a perfectly free cæcum, in the presence of general intestinal distention, reached no further downward than to protrude into the transverse wound opposite the anterior superior spine of the ilium, then but little slack could be drawn from any one direction, yet a little more could be drawn from above than from either side, and it was found that the greatest amount of slack could be pulled out of the peritoneal cavity by placing the holding-stitch in the presenting cæcum at a site corresponding to the middle of the incision through the abdominal wall, and pulling on it in a downward and forward direction. With this fixation of the bowel the further technic of adjusting the instrument was carried out in accordance with the regular plan.

*Fixation of the Instrument in the Bowel* (Fig 5) —The success in introducing the spiral (A, Fig 1) within the bowel depends upon the ability to keep the extremity of the spring free from catching on a fold of bowel. The position of the gut most favorable for the introduction of the spiral through the perforation is the tent-like fold brought into being by



traction on the holding-thread after puncture of the bowel has been made. With the shaft of the instrument held perpendicularly to a plane passing between the two slopes of this tent-like fold of bowel, the extremity of the spiral is made to enter the puncture and to then turn into the lumen of the bowel between the layers of the fold, which latter it can be made to escape until it has nearly made the complete turn and comes up into the top of the tent.

To keep the extremity free during this manipulation, the rim of the introduced portion must first be pushed away from the operator against the bowel surface on the further side of the holding-thread (Fig 5, *T*), and later, as the introduction progresses, with this site of contact of the rim with the bowel maintained, the extremity is made to sink posteriorly into the bowel cavity. When the extremity reaches the top of the tent-like fold, it catches on the mucous membrane and just afterward the perforation comes up against the binding post (Fig 5, *P*), thus causing a gathering of the bowel at the opening of the spring. This gathering makes it impossible to draw the perforation in the bowel around the corner where the spiral joins the binding post by further pulling on the holding-thread. The obstructing fold can, however, be liberated by traction on the bowel just proximal to the perforation in a direction toward the operator (Fig 5, *arrow*), which first pulls the gathering out flat, thus clearing the extremity of the spring, and then, continued in the same direction, readily draws the opening in the gut around the corner of the instrument.

In introducing the point of the spiral through a puncture in a thick piece of gut, as the sigmoid flexure in the making of an artificial anus, it may be necessary to grasp with forceps and evert the aperture in the mucous membrane.

When the cap is screwed down into place, compressing the bowel against the ring, the axis of the metal pipe (Fig 2, *G*) leading from the cap should be out of the line of the binding post (*P*) and the arm *E* (Fig 3 *b*), so that if it be found necessary to clear the drainage channel by passing a fine probing instrument through the metal pipe into the bowel, such instrument will not meet with the obstruction of these cross-lying

metal parts A glass tube connection should be made to interrupt the continuity of the rubber drainage tube near the instrument

*Fixation of the Fistula Instrument to the Abdominal Wall*

The technic of fixation of the fistula connecting-joint grasping the bowel, to the abdominal wall, described in the legends of Figs. 4, 6, and 7, seems to be a correct one for the transverse abdominal incision here recommended At the site of this incision the structure of the abdominal wall is very thin at the linea semilunaris, external to which it gradually increases in thickness, so that the fixing of the cap (diameter of base 43/48 inch) of the instrument in this situation to the front of the aponeurosis of the external oblique 1 cm from its cut edges, and the drawing of the deeper structures of the abdominal wall in a collar around the intestine beneath the base of the instrument, seemed always capable of accomplishment without compromising too much of the lumen of the bowel In a thick part of the abdominal wall, however, the instrument should probably rather be anchored to the edges of the superficial portion of the wall structure In the patient, with the latter technic, and using an instrument having a base one inch in diameter, a little more than half the lumen of the bowel was taken up in a transrectus wound

The ends of the silkworm-gut stitches anchoring the instrument in the wound should be left long to facilitate removal of the stitches The gauze collar at the junction of the instrument with the bowel should be drawn well up against the base of the instrument after the fixation stitches have been tied The superficial wound should be packed loosely with gauze

*The Removal of the Fistula Instrument*—In the fifth dog the instrument had cut through the bowel within 22 hours The adhesions around the fistula in this animal (Fig 7) were very strong, as also were those in the patient, who had lived an equal length of time following the operation Unless the ends of the fixation stitches be left long, it is difficult to find and cut loose these stitches The gauze collar should be left in the wound, to come away by ulceration, lest, if forcibly removed too early, important adhesions be torn

# RUPTURE OR SPRAIN FRACTURE OF THE LIGAMENTUM PATELLÆ.

BY WILLIAM H. LUCKETT, M D,  
OF NEW YORK CITY

RUPTURE of the quadriceps tendon above the patella is fairly frequent. Fracture of the patella is common, but rupture of the tendon below the patella is rare. The case reported below probably belongs to the class first described by Collender. Sir Win. Bennet has also called attention to this class of injury, and Ross and Stewart have recently carried on some experimental work, the correctness of which this case tends to prove.

R. D., casemaker, fifty-one years old, admitted to my service at Bellevue and Allied Hospitals, Harlem Division, Jan. 7, 1912, discharged cured Feb. 12, 1912.

*Present History*—Patient is said to have fallen in the street while under the influence of alcohol, so the exact mechanism of the injury is not known. The patient says that his right foot slipped forward and then he fell onto his right side on top of his right leg. The patient was unable to walk and unable to extend the right leg at the knee.

*Examination*—Inspection reveals obliteration of the normal topography of the knee, some slight ecchymosis, and a small abrasion of skin over patella. The patella is on a higher level, about  $1\frac{1}{2}$  inches, than its fellow of the opposite side, on flexion of the leg upon the thigh the patella does not move downward.

*Palpation*—The tendon cannot be felt at the lower border of the patella. The patella itself is very freely movable. A groove can be distinctly felt just beneath the lower border of the patella, running transversely across the knee, no crepitation.

An X-ray picture (Fig. 1) shows the patella tendon pulled away from its attachment to the patella, curved backward and tucked in between the femur and tibia in the intercondylar notch. There can be seen in the X-ray picture also some fragments of the bone that were pulled away from the patella. The power of extension is totally lost.

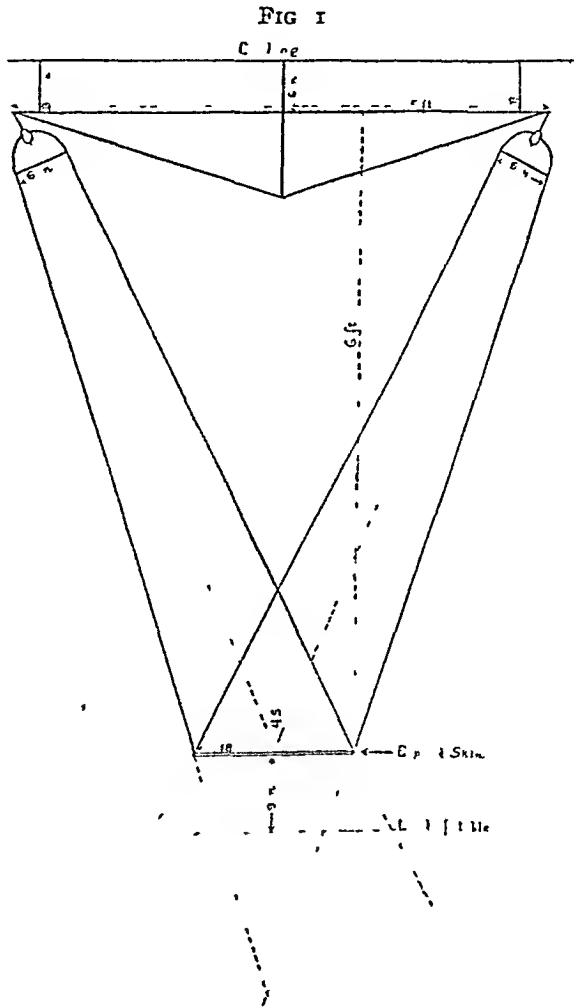
*Operation* (Jan 12, 1912) —The joint was opened by a semi-circular incision sweeping downward from the inner condyle around beneath the patella and upward to the outer condyle. The skin and soft parts were retracted, the joint opened and irrigated with 0.5 per cent carbolic solution. A blood-clot and the torn end of the tendon was withdrawn from its prolapsed position in the intercondyloid notch. The tendon was sutured to the aponeurosis and periosteum of the patella with kangaroo tendon. The lateral expansion of the aponeurosis was found to be torn through almost one-half the circumference of the knee. This was sutured with kangaroo tendon. The skin was then sutured, posterior splint applied. January 24, twelve days after operation first dressing, wound perfectly clean, primary union. Aside from a profound bromide rash the patient had an uneventful recovery. The bromides were administered enthusiastically by the house-surgeon to control alcoholic delirium tremens. The patient, in fact, was in mild delirium for the first three weeks of his sojourn in the hospital.

The tear or rupture of the lateral expansion of the aponeurosis of the quadriceps tendon in this case was no less important than the injury to the tendon itself. The injury to the aponeurosis was very much more extensive than is usually found accompanying fractures of the patella. The fascia lata over the knee is very strong, and receives fibrous extension from the tendon of the biceps externally and from the sartorius internally and quadriceps extensor cruris in front. So it will be seen that through it there are exercised great powers of extension. It is just as important to close this rent in the fascia lata as it is to repair the rupture of the tendon itself. In this case the tear of the aponeurosis was so extensive as to reach through half of the circumference of the knee, necessitating an extension of both ends of our skin incision to reach its limits.

# A METHOD OF FOCUSING SEVERAL ELECTRIC LIGHTS ON THE FIELD OF OPERATION.

BY WILLARD BARTLETT, M.D.,  
OF ST LOUIS, MO

It is not the writer's primary object to discuss, in this brief article, the relative merits of natural and artificial light-



Showing how the light is converged from the six-inch reflectors into an 18-inch field

ing for the operating room, however, it may not be out of place to mention, in passing, the inherent difficulties connected with the skylight, which has heretofore afforded practically

ture, going as high as  $102.5^{\circ}$ , and this continued for two weeks without apparent cause. There was no ascites. It had been suggested that perhaps this temperature elevation was an essential feature of the disease itself.

DR GERSTER, in closing, said that in his case he did not doubt that there was a thrombosis of the portal vein, and such thrombi were usually accompanied by temperatures showing a very steep curve. If the thrombus happened to be of a septic nature, death usually followed, but even under those grave conditions recoveries had been reported.

### TUBERCULOSIS OF THE COSTAL CARTILAGES

DR A. V. MOSCHCOWITZ presented a negro, 38 years old, who was admitted to the Mt. Sinai Hospital on September 23, 1912, with the history that one year ago his right great toe was amputated at his home for osteomyelitis. Ten years ago there was a genital infection for which the patient was treated with mercury and iodides.

His present history dated back ten months, when there developed a tender mass over the lower part of the right chest. This was incised and drained, and had been discharging pus ever since that time. On physical examination there was found a sinus just below the right nipple, which led to a depth of about four inches in various directions. The axillary, femoral, and epitrochlear glands were enlarged, and there was a tubercular infection of the apex of the left lung.

The patient was operated on by Dr. Moschcowitz, on September 28, in the following manner. A rather irregular incision was made, exposing all the diseased cartilages and one rib. The diseased tissue was then thoroughly extirpated, and the exposed cartilages were covered by flaps of muscular or aponeurotic tissue obtained from adjacent structures, and the entire wound was closed with the exception of that part which corresponded to the necrotic rib.

The sutured portion of the wound healed by primary union. On October 19, there was a small collection of serum at the inner angle of the wound, which had to be opened, but the speaker said he did not believe that this led down to the cartilages.

The pathological report by Dr. F. S. Mandlebaum confirmed the diagnosis of tuberculosis.



# TRANSACTIONS

## OF THE

### NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, held at the New York Academy of Medicine,  
October 23, 1912*

The President, DR CHARLES L GIBSON, in the Chair

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#### BANTT'S DISEASE

DR ARPAD G GERSTER presented a man, 25 years old, who was admitted to the Mt Sinai Hospital, on December 3, 1909. The history obtained was that about a year prior to his admission he began to experience a heavy dragging sensation in the abdomen, with slight pain in the back. The pain gradually became more severe, and was located principally in the left hypochondrium and in the lumbar region. The pain did not radiate. There was frequency of urination, both diurnal and nocturnal, with hæmaturia. The patient said he felt weak, and had lost some weight.

Examination revealed a large tumor filling up the entire left upper quadrant and extending somewhat beyond the middle line. This tumor mass had a rounded border and was very mobile, so that it could be pushed from side to side. On inflation of the colon there was tympany in front of the mass. The urine always contained considerable albumin and many red blood-cells, no tubercle bacilli. An examination of the blood gave 4800 white blood-cells, with 85 per cent of hæmaglobin.

The case was diagnosed as one of Banti's disease, and in December, 1909, Dr Gerster removed the enlarged spleen through a six-inch incision made parallel to the costal border. The spleen was freely movable, but it was found to be adherent to the stomach above, necessitating resection of a segment of the fundus two and a half inches long. The defect was afterward closed by double suture. The liver was found shrunken and of



The above reasoning should not, perhaps, lead one so far as to conclude that the ideal operating room of the future will be constructed without a skylight, but the thought suggests itself forcibly as I employ an artificial lighting system which I recently devised for St Anthony's Hospital. Two diagrams are submitted which will, I think, make clear the manner in which I have used six electric globes of 15-candle-power with a parabolic reflector behind each. This is the ordinary equipment seen upon modern automobiles, and, as is well known, each light throws a powerful beam, the rays of which diverge but slightly. When six of these, situated at different points, are focused on a given field it stands to reason that the illumination is intense and that in this manner shadows are practically done away with. The source of light is so near the ceiling that no heat from it is noticeable at the level of the operator's head. The globes are frosted and a soft, diffuse glow results. The satisfaction of having a known quality and constant quantity of light at all times is one which will not be fully appreciated by the operator who has not been in possession of it. The fact that beams of light from six sources meet at an angle of more than forty-five degrees naturally cuts out all the shadows which obscure the depths of certain wounds. This will be especially appreciated in certain common duct operations, pelvic procedures, attempts to reach the root of the gasserian ganglion, and others of like nature.

It required some calculating and experimenting on the part of an expert electrician before we secured exactly the "resistance" which brought out the full brilliancy of these tiny six-volt globes. The cost of the material used was less than \$25 00—surprisingly little when the result is considered.

Requests for technical information will gladly be turned over to the expert connected with the supply house where my material was purchased.

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the hob-nail type. The abdominal wound was closed, with drainage, and the patient's convalescence was uneventful for ten days, when he developed a high temperature, with remissions and chills and free fluid in the peritoneum. Thrombophlebitis of the splenic vein was suspected, and twelve days after the original operation the abdomen was again opened through a median epigastric incision. There were no evidences of peritonitis, but the abdomen was found to be filled with bloody serum. All the different branches of the portal vein were much distended, the splenic vein exposed by an incision through the lesser omentum being as large as a man's thumb. No clot could be found. The patient's condition at this time was not very favorable, and further operative search was abandoned.

Following this exploratory laparotomy, the patient's temperature ranged between  $99^{\circ}$  and  $102^{\circ}$  for two weeks, with occasional chills. Then, after 35 days, it gradually fell to normal, the patient continued to improve, and was discharged, well, on March 9, 1910.

Dr Geister remarked that the pain and tumor in the left flank and hæmaturia, which was traced to the left kidney, naturally led to the suspicion that this kidney was either accidentally or coincidentally involved with the spleen. As subsequent events showed, the renal symptoms were entirely due to compression, and all the symptoms, including very characteristic attacks of renal colic, which, in fact, was the symptom that had brought the man to the hospital, disappeared with the removal of the enlarged spleen.

Dr WALTON MARTIN said he had seen a patient with great enlargement of the spleen and slight enlargement of the liver about four weeks ago, and with slight anæmia, and no leucocytosis. The case suggested the one shown by Dr Gerster. As the patient's condition was fair, and as there had been no hemorrhages, surgical operation had not been advised. The favorable outcome in Dr Gerster's case would lead Dr Martin to advise an operation in this case.

Dr CLARENCE A. McWILLIAMS said he recently saw a typical case of Banti's disease at the Presbyterian Hospital. The spleen was very much enlarged, and Dr Joseph A. Blake removed it with considerable difficulty on account of adhesions. Three or days after the splenectomy the patient developed a tempera-

ture, going as high as  $102.5^{\circ}$ , and this continued for two weeks without apparent cause. There was no ascites. It had been suggested that perhaps this temperature elevation was an essential feature of the disease itself.

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for intrathoracic operations led to considerable experimental activity along this line in the laboratory of Francois Frank, and as a result we find two forms of positive pressure apparatuses emanating from this laboratory as early as 1896. Tuffier and Hallion<sup>21</sup> proposed a method whereby the disadvantages and dangers of pumping air in and out of the lungs were avoided by connecting with a pressure reservoir a tube introduced through the mouth and made to fit the trachea tightly by a specially designed clamp, by suitable valves the expiration was opposed by a water valve of 20 cm. pressure, thus keeping the lungs distended. The exchange of air, however, had to be entirely maintained by the natural respiratory movements of the animal against this pressure. Quenu and Longuet<sup>22</sup> arrived at the same result by using a head-piece or mask, like a diver's helmet, in which positive pressure was maintained and which proved to be the forerunner of the later improved positive pressure cabinets.

In 1904, Sauerbruch,<sup>23</sup> at the instance of Mikulicz,<sup>24</sup> made a most comprehensive study of the question of surgical pneumothorax. His monograph stands as the basis of all recent work on the subject, in this Sauerbruch followed up the suggestion made by Woillez<sup>25</sup> in 1875 as to the advantages of negative as opposed to positive pressure, and enlarged the latter's "Spirophore," first to a small cabinet just large enough for animal work, and then into his now famous negative pressure operating room with its complicated accessories. The evident excellence of this piece of work, backed by the prestige of Mikulicz, brought about the general acceptance of Sauerbruch's conclusions in regard to the advantages of negative as opposed to positive pressure, notwithstanding the fact that Brauer<sup>26, 27</sup> and many others soon demonstrated that physiologically there is no difference between the two methods, and that from the practical stand-point the positive pressure apparatus is preferable. All are, in a general way, familiar with the various differential pressure apparatuses as devised by Sauerbruch, Brauer, Tiegel,<sup>28</sup> Meyer,<sup>29</sup> Robinson,<sup>30</sup> and many others, by means of which great advance has recently been made in thoracic surgery; accordingly we will not consider the details of the various modifications.

However, all these differential pressure apparatuses, whether negative or positive or even combined, are designed to render possible *spontaneous respiration* under conditions of surgical pneumothorax, they do not provide any efficient and practical means of aiding respiration, whenever for any cause such spontaneous respiration ceases. Further, it is practically impossible, or at least very difficult, in the case of an anæsthetic accident for the administrator to render material assistance on account of the mechanical interference of the apparatus. In consequence it is no wonder that a method,

sutures were inserted to completely obliterate the pelvis. Primary union resulted, and the patient left the hospital three weeks from the date of the operation. At the present time there was not the slightest evidence of a protrusion, even upon great exertion. The sphincters had regained their normal condition, and the result thus far might be termed an ideal one.

DR HOWARD D COLLINS said he thought that Dr Moschcowitz's idea of obliterating Douglas's cul-de-sac in the treatment of prolapse of the rectum overcame one difficulty which was met with in these cases. His own method had been to suture the lines of the rectum to the peritoneum on the pelvic wall, and his results had been perfectly satisfactory excepting in those cases where the patients had been allowed to become constipated during the period of their convalescence. His method, the speaker said, had a tendency to flatten out the rectum, and if a large mass of fecal matter was allowed to pass through the rectum, the stitches were torn out or the peritoneum was stretched to such a degree that the benefits of the operation were lost, whereas the method described by Dr Moschcowitz had a tendency to keep the lumen of the rectum open.

DR JAMES M HITZROT said he could speak in favor of this method from personal experience. In July of the present year a young woman entered the New York Hospital, presenting a rectal prolapse of about six inches, which she had had since she was a small child—she was now a girl of twenty. Dr Hitzrot said he operated on her by this method with very good success. He had intended to show her at this meeting, but she left the hospital three weeks after the operation and had returned to her home in Nebraska.

DR F KAMMERER inquired if this method was not similar to that described by Quénu and Duval, in the *Revue de Chirurgie*, February, 1910. About a year ago, the speaker said, at one of the meetings of this Society, he showed a patient upon whom he had done the operation, as described by these two authors, apparently with very satisfactory results. The patient was a woman with a rectal prolapse of four or five inches, which he had previously tried to correct by various expedients but without success. The prolapse was originally of traumatic origin. After carrying out the method described by Dr Moschcowitz, the patient remained well for about ten months, then the prolapse recurred.

Dr Moschcowitz said he presumed he only voiced the sentiments of other surgeons when he stated that tuberculosis of the cartilages of the ribs was rather difficult to cure, no matter how radical the procedure adopted to eradicate it. The speaker said that, as a matter of fact, he had noticed that this was also true when operating upon cartilages in other parts of the body, and he had been led to the conclusion that this failure to effect a cure was due not so much to the inadequacy of the operative method, but to the after-treatment. When operating on such infected tissues, it was quite natural to take recourse to packing the wound with either sterile or iodoform gauze. Here, he believed, was just where the fault lay in our failures to cure these patients. The low vitality of cartilaginous tissues was well known, and they would not tolerate any prolonged contact with gauze. In this case, therefore, he had adopted a different procedure, and a few days before his attention was called to an article by Axhausen, in Langenbeck's Archiv, in which the writer advocated a similar method.

Dr Moschcowitz said he expected to report the final outcome of this case at a later date.

#### PROLAPSE OF THE RECTUM

Dr. Moschcowitz presented a woman, 55 years old, who was admitted to the Mt Sinai Hospital, in the service of Dr Arpad G. Gerster, on March 16, 1912. The history obtained was that for the past 25 years she had been suffering with symptoms of a mass protruding from the rectum. These symptoms had become particularly aggravated during the past three years, so that during that time she had made no attempts whatsoever to reduce the mass, which she had previously been able to do.

Examination showed a protruding prolapse of the rectum, about three and a half inches in length. The sphincters were completely relaxed, easily permitting introduction of the entire hand. The surface of the prolapsed rectum was ulcerated from constant friction against the clothing.

Operation, March 21, 1912: The method of procedure in this case was that described by Dr Moschcowitz in an article entitled "The Pathogenesis, Anatomy and Cure of Prolapse of the Rectum," which was published in *Surgery, Gynecology and Obstetrics*, July, 1912. Four rows of circular Pagenstecher

years ago Bardenhauer operated on these cases by a method not unlike that of Quénu and Duval

DR KAMMERER said that in the remark he made he did not have in mind the question of priority. He had not yet read Dr. Moschcowitz's recent publication and, before discussing the subject, wished to know if the two procedures are based on the same principle of technic

#### TUBERCULOSIS OF THE SHAFT OF THE LONG BONES

DR FRANK S. MATHEWS showed three cases of tuberculosis of the shaft of the long bones not involving the adjacent joints. In the first case, a focus in the lower end of the humerus had made a fusiform swelling above the elbow. The tuberculous segment had been excised subperiosteally and the wound closed. The segment had re-formed in two months.

In the second case shown there was tuberculosis of the whole shaft of the humerus, with many sinuses, but no X-ray or clinical evidence of joint involvement. Early treatment like that in the first case might have resulted in a cure without the present extensive involvement of bone and soft parts.

The third case was a tuberculosis of the lower half of the shaft of the femur. An abscess and sinus had formed, and the bone destruction had been considerable. The child's condition was desperate. Subperiosteal resection of the lower half of the femur down to the epiphyseal cartilage of the knee had been done. Bone had re-formed, but there was still a sinus.

Dr Mathews, while in general advocating the orthopaedic rather than the operative treatment of joint cases, urged the wisdom of early diagnosis of foci in the shaft or ends of diaphyses of the long bones, and their early subperiosteal removal to prevent joint tuberculosis and to curtail the period of treatment.

DR MARTIN, referring to an X-ray negative which he had shown in connection with the cases presented by Dr Mathews, said the case was that of a child, two and a half years old, where a large section of the shaft of the ulna had been removed for tuberculosis. There were no sinuses, and the child made a good recovery without involvement of the joints. The case was exactly similar to those reported by Dr Mathews.

DR RUSSELL said he was interested in the statement quoted by Dr Mathews that a resection of the shaft did not interfere



with the growth of the bone, as there was a rather wide-spread belief among surgeons that resection of the long bones in children might result in possible shortening. The speaker said there were several cases of compound separation of the lower epiphysis of the femur in which the diaphysis had been resected, resulting in progressive shortening extending over several years.

DR GERSTER said that Dr Mathews, in his presentation of these cases of tuberculosis of the shaft of the long bones, touched upon a very important surgical principle. In the early days of aseptic surgery, when we first began to attack tuberculous joints under the leadership of Professor Volkmann, the tendency was to go too far, and primary resections were very common until we were frightened from that extreme position by the observation that many cases of miliary tuberculosis followed these extensive surgical procedures. The dictum then taught that tuberculosis of the joints should be regarded and treated like a malignant disease was gradually abandoned, and we swung back to the other extreme and turned these cases over to the orthopædists, who achieved such brilliant results with orthopædic measures combined with general treatment that radical surgical interference was rarely resorted to.

In the cases shown by Dr Mathews the fact was demonstrated that when we had to deal with a tuberculous focus either in the diaphysis or epiphysis of the long bones where perforation into the joint was to be feared with reasonable certainty, it was rational to cut down and remove that focus. This was one of the teachings of Volkmann, and now, when, with the aid of the X-rays, an early and accurate diagnosis could easily be made, this operation deserves to be characterized as eminently conservative.

DR MATHEWS, in closing, replying to Dr Russell, said that in making the statement that resection of the shaft of the bone did not interfere with its growth he had quoted Stiles as authority for the statement.

Dr Mathews said that in the three cases he had shown, the conditions were not ideal. In dealing with an early tuberculosis of the shaft, he thought it was better to do a resection than to rely on the expectant treatment with the risk of perforation into the joint. Personally, he was strongly opposed to a resection of the hip in a child as the result was usually very bad, with de-

cided shortening After such a resection, the arrest of growth was not limited to the hip, but involved every epiphysis from the hip down to the toes, and the resulting shortening was very pronounced, sometimes as much as ten inches Dr. Mathews said he had never seen this fact mentioned in the text-books

DR. ROYAL WHITMAN said he had thought it well known that in cases of hip-joint disease in childhood, whether operated on or not, or whenever from any cause there was loss of function for a long period, growth was checked in some degree, not only in the bone directly involved, but in all the bones and tissues of the limb

#### TRAUMATIC SEPARATION OF THE LOWER EPIPHYSIS OF THE FEMUR

DR JAMES I. RUSSELL read a paper with the above title, for which see page 869, vol lvi

DR. GERSTER said that one of his earliest surgical experiences dated back to the year 1872 or 1873, while serving as assistant surgeon in the Austrian army One day a young recruit was struck on the head by a heavy straw mattress, which had been thrown from one of the upper floors of the barracks Upon recovering consciousness he was unable to walk and complained bitterly of pain in one of his legs A dislocation of the knee-joint was suspected crepitus was felt, a large hæmatoma rapidly developed, and separation of the epiphysis was diagnosed The fragments were easily replaced, and the patient eventually recovered with good use of the limb The toes being cold, this and the presence of the hæmatoma led to the suspicion that a large vessel might have been ruptured This fear proved to be groundless

## BOOK REVIEW.

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**SURGICAL AFTER-TREATMENT** By L R G CRANDON, M D , Assistant in Surgery at Harvard Medical School, and ALBERT EHRENFRIED, M D , Assistant in Anatomy at Harvard Medical School. Second edition, practically rewritten Octavo of 831 pages, with 264 original illustrations Philadelphia and London. W B Saunders Company, 1912

THIS work, now in its second edition, has been thoroughly revised and in large part rewritten. It is intended to appeal especially to hospital residents, surgical assistants, and those who are called upon to care for surgical cases in communities which are not hospital centres.

Although completely modernized, most of its contents are teachings which have stood the test of time, and which represent not only the originality of the authors but also the generally accepted thought and practice in the care of surgical patients.

The work is divided into two parts, the first of which contains chapters given to the consideration of subjects of general interest, such as the arrangement of the sick-room, the nurse's chart, post-anæsthetic nausea, pain, shock, coma, hemorrhage, pulmonary embolism, and artificial respiration. Then follow chapters on diet, rectal feeding, catheterization, the care of the bowels, acute gastric dilatation, and post-operative intestinal obstruction. Bandaging, the management of the operative wound, dressings, removal of sutures, and the subject of drainage are next considered, together with the management of infected wounds, sinuses and fistulae. Part I is concluded with a consideration of the indications for massage, X-ray therapy and radium, and somewhat out of order, so far as the arrangement of the text is concerned, is here added a chapter on the preparation of the patient for operation.

In Part II the management of post-operative conditions is considered in regional form, a chapter being given to each of the principal regions of the body and to each group of organs or tissues of similar structure. In these chapters are discussed not

only the normal cases but also the management of the various complications and abnormalities to which each one is subject

One of the most valuable contributions to the work is the chapter on therapeutic immunization and vaccine therapy which was prepared by Dr George P Sanborn. It is thorough and at the same time concise, and presents all of the more important essentials for the application of this valuable adjuvant to surgical science

A complete index of authors is appended, and the text is liberally interspersed with charts, drawings, and photographic reproductions, most of which are original and serve well to illustrate the methods and ideas as described in the text. On the whole, the book is a very satisfactory and comprehensive treatise on the subject of surgical after-treatment and serves admirably the purpose for which the authors have intended it

WALTER A. SHERWOOD

**THE PITUITARY BODY AND ITS DISORDERS** By HARVEY CUSHING, M D, Associate Professor of Surgery, The Johns Hopkins University, Professor of Surgery (Elect), Harvard University. Octavo, 341 pages, 319 illustrations. Philadelphia and London. J B Lippincott Company, 1912

ONLY at rare intervals in the history of medical literature does a book appear which stands out as something striking and fundamental. Such an epoch-making volume is Cushing's recent classical monograph on hypophyseal disease. Though numerous scattered papers have been published in the past twenty-five years, and especially in the last decade, on the disorders of the pituitary body, it has remained for an American surgeon to give to the world for the first time a systematic and crystallized conception of the varied clinical manifestations resulting from pathological lesions of this organ. The book is no mere compilation of the literature, but is mainly the result of a most extensive personal clinical experience and experimental research, and it will undoubtedly rank as the reference work of the future on the diseases of the hypophysis cerebri. It is possible that some of Cushing's deductions may be disproved by coming investigators, yet it is certain that his book will stand out pre-eminent as the first attempt to present in a concrete scientific form a com-

Dr Kammerer said that in dealing with this condition of rectal prolapse he had seen good results following various operative expedients, including that of Dieffenbach of excision of the posterior wall of the rectum, together with the sphincter, also by denudation of the iliac fossa and attaching the bowel to the denuded surface. The success of the operation depended largely upon the kind of prolapse one had to deal with.

DR. HENRY H. M. LYLE said he had tried the method described by Dr Moschcowitz in a case of prolapse of the uterus, with descent of the posterior wall. In this case, closure of the cul-de-sac of Douglas gave very good support. The operation was done two months ago, and the patient's condition was thus far very good.

DR. GERSTER said his experience with the various operations for the correction of rectal prolapse had been very similar to that of Dr. Kammerer, and while the results of many of these procedures were excellent, they were, unfortunately, only temporary. The studies of Dr Moschcowitz had demonstrated that the failure to obtain permanent relief was due to the fact that we had neglected to seek out and correct the real causative factor of this condition, *i e*, that a prolapse of the rectum was always due to a laxity of the pelvic floor, and this could not be better remedied than by the method employed in the case shown at this meeting. Of course, the method was still in an experimental stage, but it came nearer the purpose than any of the two score or more plastic procedures that had been recommended and tried heretofore. In women, the operation described by Dr Moschcowitz was comparatively simple, in men, it would sometimes prove very difficult. If a sufficient number of sutures were placed, the final outcome of the operation, which was still in doubt, should be very good.

DR. MOSCHCOWITZ said that entirely aside from making any claim of priority for this method of operation, he merely wished to call attention to the fact that Quénu and Duval published their article on the subject in the *Revue de Chirurgie* in 1910, while he did his first operation by this method fully five and a half years ago. The speaker said that while abroad this summer he discussed the subject with Dr Quénu, who had informed him that the idea of their operation was essentially a colopexy. In this connection he might call attention to the fact that over ten

graphic study as a means of orientation, the necessity of perfect anæsthesia, and the danger, if one's direction is wrong, of perforating the cribriform plate of the ethmoid, are emphasized

By the transphenoidal approach local sellar decompression, partial extirpation, or cyst evacuation may be accomplished. A subtemporal approach may be used for simple decompression, especially in superimposed lesions, or for combined decompression and exploration. Finally both avenues of approach, intra- and extracranial, may be combined. Cushing has performed these various operations either single or combined on 43 patients, who have been subjected, all told, to 61 operations. A table of these cases is appended. Of the 43 cases, only 28 are included in Part II, and 15 are new cases added since the completion of that portion of the work. Cushing has had by far the largest individual operative experience, and his results are, for this reason, if for no other, of the utmost significance. The mortality in 29 actual transphenoidal attacks was only 13.7 per cent. The main result of operation has been the relief of neighborhood symptoms. Symptoms of intracranial tension are likewise improved, and it is hoped that hyperpituitarism may yet be influenced. Glandular implantation in hypopituitarism is looked upon as a further possibility of surgical intervention. Further, a preliminary sellar or subtemporal decompression, or both, is suggested as a means for more effective radiotherapy.

The matter of glandular therapy in hypopituitarism by ingestion and injection is next taken up. Cushing has seen some very definite results from these measures, particularly as far as the adiposity and the subjective symptoms resulting from glandular insufficiency are concerned. An ingenious suggestion for determining the dosage is offered. The patient should be given daily enough glucose to cause glycosuria in a normal person of equal body-weight and then increasing amounts of glandular extract are given till a trace of sugar occurs in the urine of the patient, who, of course, originally had an increased tolerance. Injection is the more effective measure, and in two cases overcame the somnolence, when feeding failed.

The possibility of the beneficial effects of glandular transplantation are considered, and one case is recorded in which Cushing had the opportunity to carry out this procedure. The result was extremely satisfactory.

X-ray treatment, especially in combination with operative measures, promises to be useful in cases of strumous hyperplasia, especially where the tumor symptoms predominate. Neighborhood and pressure symptoms have both been influenced in some of the later cases, and it is suggested that the X-ray may effect the growth of cells in the struma, much in the same way as the cell division of the spermatogenous epithelium of the testis is arrested.

An exhaustive bibliography of 256 numbers completes the volume.

Possibly some will feel that Cushing is a trifle too speculative in his inferences and somewhat over-enthusiastic in his conclusions. These attributes, which give the work a distinct individuality, merit rather praise than condemnation. Would any scientific progress be possible without a certain amount of imagination and optimism on the part of the investigator? Cushing's book is a great step forward, and it will be an enduring monument to the earnest and able efforts of its author. The volume should be in the private library of every physician, for there is practically no specialty in medicine which is not overlapped by the subject under discussion. Of especial importance, however, is the book to the surgeon, for it is from him that the definite practical results are to come in the treatment of those unfortunates suffering from pituitary disease.

DE WITT STETTEN

## CORRESPONDENCE.

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### ACUTE SUPPURATING BURSITIS OF THE SUBDELTOID BURSA.

EDITOR ANNALS OF SURGERY.

As instances of acute suppurating inflammation of the subdeltoid bursa are not common, the report of a case with the ultimate results may not be out of place

W C R., male, aet 40 years, was first seen on September 15, 1909. A strong, well-built man, who had always enjoyed excellent health. He had never contracted gonorrhœa nor syphilis. For two days before coming under observation the patient began to experience severe pain in the right shoulder. The pain came on suddenly without any known cause, and increased to such a degree that within forty-eight hours the patient was in real agony.

Examination showed no change in the shoulder by inspection. Palpation revealed nothing excepting some pain over the deltoid, but any movement of the shoulder would cause great pain. Local applications and the internal administration of sodium salicylate gave no relief after two days' trial, the pain continuing so severe that morphine had to be given. Temperature was always normal.

On September 18 the shoulder was radiographed and a distinct outline of the subdeltoid bursa was revealed (Fig 1) and the correct diagnosis arrived at.

Operation was done on September 19, with the kind assistance of Dr F J Cotton. A posterolateral incision ten centimetres long was made, the fibres of the deltoid separated by blunt dissection, and a tense subdeltoid bursa readily brought to view. Upon incision, about five cubic centimetres of thick yellow pus escaped, which was unfortunately lost for bacteriological examination. The bursa was easily extirpated and a small rubberdam cigarette drain inserted, after which the wound was closed. Drain removed in forty-eight hours.

The arm was put up on a Munk's rectangular splint, which was worn for three weeks, after which passive and active motions



FIG. 1

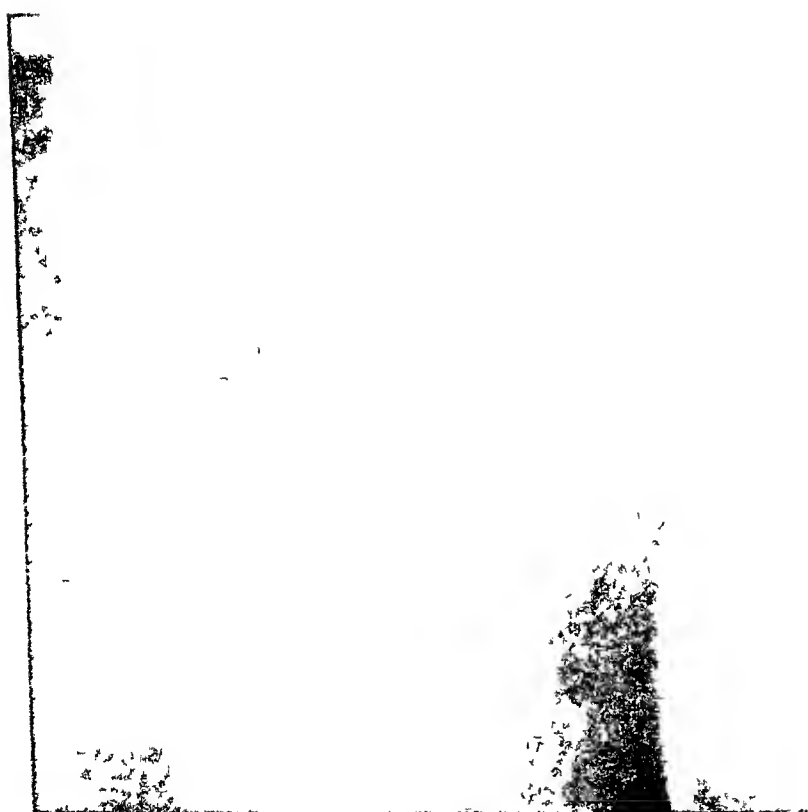


FIG. 1. Joint of a rabbit with bursitis.

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were begun, with the result that within six weeks after the operation the patient had very fair use of the arm. At the present time of writing (October 12, 1912), three years after the interference, the patient has a perfect functional result.

The obscurity of the etiological factor in this case is interesting, as the patient had never had a urethral infection, nor had he received any trauma to the shoulder. He has been in perfect health ever since.

CHARLES GREENE CUMSTON, M D,  
Boston, Mass

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## OPERATION UPON A NEW-BORN BABE

EDITOR ANNALS OF SURGERY

The rather infrequent occurrence of operation work on babes, made necessary, however, at times, is well illustrated in the following case. A male child born to Mr and Mrs Harry Elliott at 11 o'clock P M, September 13, 1912, under the professional care of Dr James A McMurray, of Marion, Ohio. The babe had an embryonal cyst of the cord, near the body, size of a large double fist, as well as an umbilical hernia which was really more an eventration than an umbilical rupture. On consultation it was decided to give the babe a chance by operative surgery, rather than trust nature. The babe was, therefore, sent to the hospital, anæsthetized with chloroform by Dr H J Lower, the mass excised, and the umbilical hernia reduced and sutured. The operative work was done on this babe exactly fourteen hours after birth. It bore the anæsthetic well, and made an uneventful recovery.

AUGUST RHU, M D,  
Marion, Ohio

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# ANNALS OF SURGERY

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VOL LVII

FEBRUARY, 1913

No. 2

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## ORIGINAL MEMOIRS

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### AN APPROACH TO THE HYPOPHYSIS THROUGH THE ANTERIOR CRANIAL FOSSA \*

BY CHARLES H. FRAZIER, M D,  
OF PHILADELPHIA

Professor of Clinical Surgery in the University of Pennsylvania

THOUGH the real advent of surgery of the hypophysis dates back little more than a half a decade—it being the last of the cerebral structures to come within the scope of surgical therapy—nevertheless in this short space of time rhinologists and surgeons have given much attention to this small and until recently very inaccessible organ, and have developed various methods of approach on the cadaver and the living subject with varying degrees of success. The hypophysis, situated as it is deep in the sella turcica and hemmed in by such important structures as the cavernous sinus, the optic tracts and chiasm, and the internal carotid artery, has for a long time been considered a *noli me tangere* by the surgeon. Indeed, in 1882, Hyrtl described even the sphenoidal sinus as being entirely beyond the reach of hand or instrument.

The incentive to surgical intervention in this particular field must be attributed to Pierre Marie, who in 1886, in a monograph on acromegaly, first suggested the etiologic relation between acromegaly and perverted function of the hypophysis. The constantly increasing number of experiments demonstrating the vital importance of this organ, and the many observations, notably Frohlich's, of the various symp-

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\* Read before the Philadelphia Academy of Surgery, November 4, 1912

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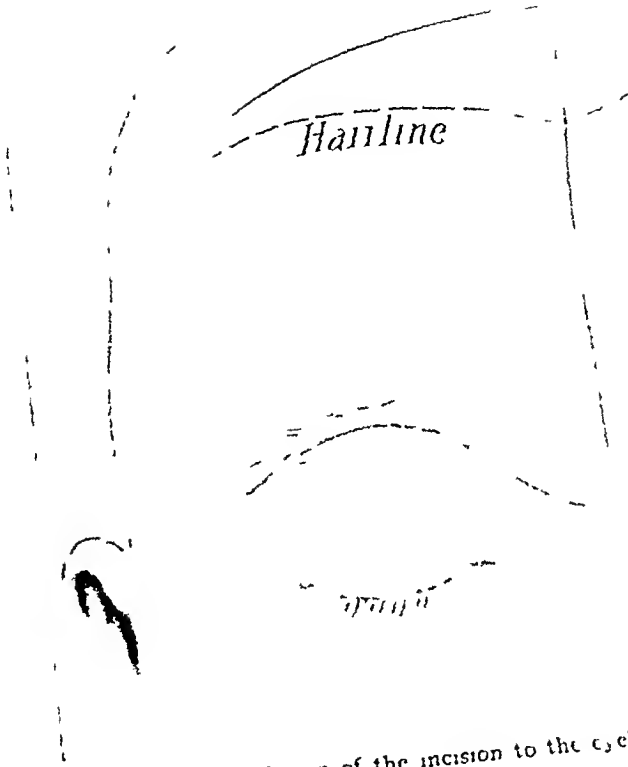
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toms complex, caused by perverted function of the pituitary and amenable in only a transitory measure to internal remedies, including organotherapy, have added greatly to the impetus to surgical intervention. Like all other intricate procedures, the operation for exposure of the hypophysis is passing through various stages of evolution, becoming constantly less complex and at the same time less mutilating, until I think I may say with perfect accuracy that I found the operation, according to the technic which I am about to describe, as easy of performance and as devoid of difficulties, though somewhat more complicated, as that on the Gasserian ganglion.

There are two principal modes of attack—the intracranial and the extracranial, each having been modified to suit the needs and the convenience of the various operators. By means of the former, the hypophysis may be reached either through the middle or the anterior cranial fossa, and the operation may be performed extradurally or intradurally.

In 1893, Caton and Paul (*Brit Med Jour*, 1893, p. 1421) conceived the idea of removing a hypophyseal growth through the middle cranial fossa by elevating the temporosphenoidal lobe, but as it happened the patient died before the operation was performed. Horsley (*Brit Med Jour*, 1906, i, 323) later removed a cyst of the hypophysis by this method, and recommends early incision of the dura. Dahlgren is also reported to have operated successfully through the middle fossa, but no details of the operation are to be found. Paulsco, Cushing and Caselli have used a very similar method in their experimental work. In 1910, Silbermark (*Wien Klin Wochenschr*, 1910, xxiii, 467) developed a temporal intracranial method on the cadaver, consisting of a bilateral craniectomy—the counter-opening allowing dislocation of the temporal lobe without danger of compression. This operation, however, has never been performed on the living. While this method has proved very successful in canine and other experimental hypophysectomies, it seems scarcely adapted to man except in very rare instances, such, for example, as when a cyst or tumor of the pituitary extends into the infundibular region, and little attention has been given of late to this procedure.

FIG 1



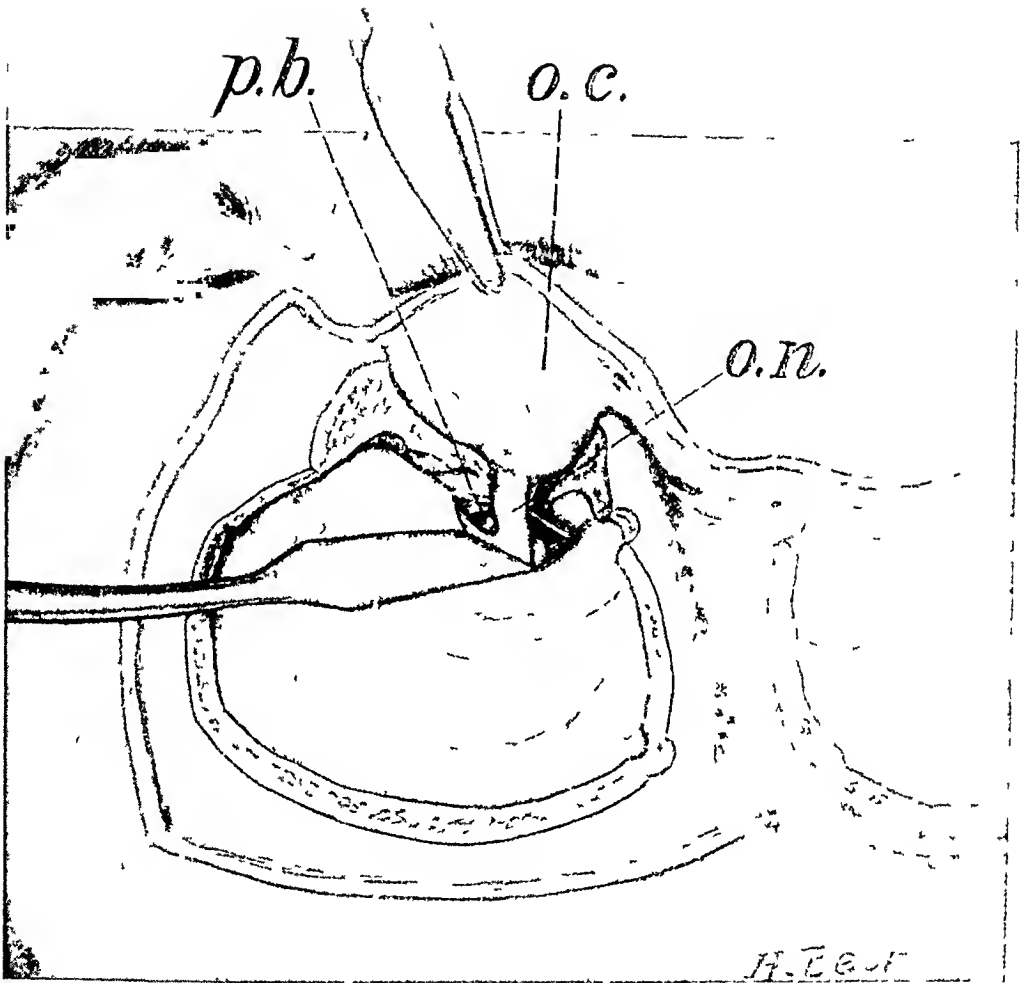
Drawing showing the relation of the incision to the eyebrow and the line





of the osteoplastic flap and between lines (a) and (b) the  
of the supra orbital ridge to be resected

FIG 3



With the head in the Rose position, after the supra-orbital ridge and what remains of the roof of the orbit have been removed, the frontal lobe is elevated with a retractor and the orbital contents are displaced downwards, exposing the optic nerve and immediately to the left of it, the pituitary body, *o c*, orbital contents, *p b*, pituitary body *o n*, optic nerve

FIG 2

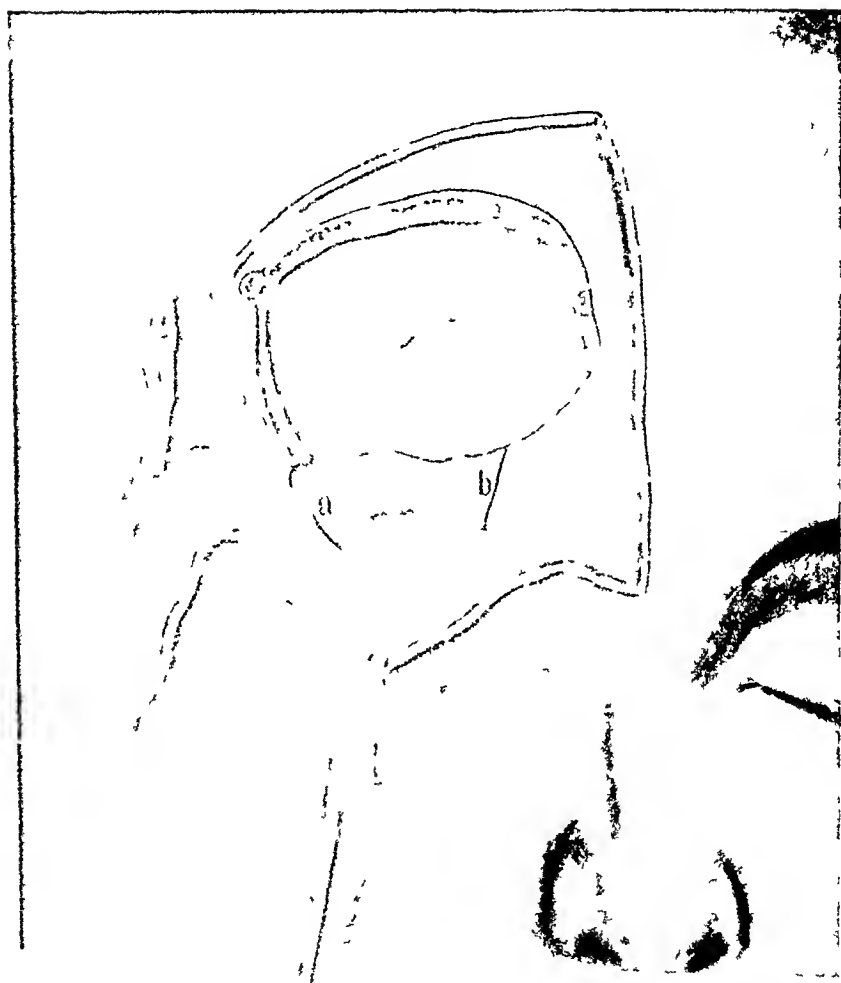


FIG 2 - The resection of the otoplasty flap and between lines (a) and (b) the portion of the supra-orbital ridge to be resected

Krause (*Den Klm*, 1905, viii, 1004) was the first to suggest approaching the hypophysis through the anterior cranial fossa, by resecting the frontal bone and proceeding extradurally until the lesser wing of the sphenoid is reached, at which juncture the dura is incised and the hypophysis easily exposed. Borchard (*Centralbl f. Chn*, 1908, lxi, 332) tried to remove a hypophyseal tumor by the above method, but was obliged to abandon the operation because of hemorrhage. Kiliani (*ANN SURG*, 1904, xl, 35) elaborated Krause's technic somewhat and advocates immediate incision of the dura. In 1908, McArthur performed an operation somewhat similar to Krause's with an unsuccessful outcome. He has since modified his technic, but has not to my knowledge practised it on the living subject. Last year Bogoiavlensky (*Jour de Chn*, 1912, viii, No 4) performed the first successful operation through the anterior cranial fossa by a method very much like Krause's.

Most of the operations thus far have been by extracranial methods, and the surgery of the hypophysis is usually said to have its advent in 1907, when Schloffer performed his first fairly successful operation, approaching the hypophysis by the extracranial and transphenoidal route, though the experimental work of König, Lowe, and especially Giordano had paved the way for the development of Schloffer's technic. The latter, however, was somewhat crude and mutilating in character, and it has remained for others to alter and refine it. Thus, in chronological order, we find Kanavel (*Journal A M A*, Nov 20, 1909) and his intranasal operation, in which the nose is reflected upwards, Halstead (*Surg, Gyn, and Obstet*, May, 1910) and his oronasal operation, in which the incision is made in the mucous membrane beneath the upper lip; and Hirsch (*Jour. A M. A*, vol Iv, p 9) with his endonasal method. The latter is the operation of choice of all the transphenoidal methods, the conspicuous feature of which is the submucous resection of the septum and vomer, thus minimizing the danger of infection. During the past year Chiari (*Wien klin Wchschr*, 1912, xxv, 1) performed two operations by a slightly different technic. He makes an incision from the inner edge of the orbit along the outer margin



portion of the roof of the orbit, later to be replaced, and in rongeur-ing away what remains of the roof of the orbit down to the optic foramen. With the elevation of the frontal lobe and the depression of the orbital contents, a free and adequate exposure is secured, and there remains only to make a short incision in the dura to lay bare the cavity of the sella turcica.

In a case referred to me recently by Dr. Franklin E. Murphy, of Kansas City, the patient, a young man of twenty-three, had been a normal child up to the age of fourteen, when he was struck with a rock over the right temporal region. Two years later, he grew perceptibly weaker, his weight began constantly to increase, and he was gradually losing the sight of his right eye. When he first came under my observation in July, 1912, his appearance was that of a thickset boy of fifteen or sixteen, with very marked panniculus adiposus. The genitalia—infantile in type—suggested a child of ten or twelve. He had an enormous appetite, and was suffering from severe headaches and occasional nausea. The ocular disturbances had advanced to a state of complete right temporal hemianopsia. Aside from these marked glandular symptoms, the X-ray findings were very suggestive of pituitary trouble. As the latter showed no material deepening of the sella turcica, I felt that the lesion would be readily exposed from above. Under intratracheal anæsthesia, the operation was carried out in the manner above described. As soon as the anterior clinoid process was reached, a transverse incision, two centimetres long, was made in the dura across from one anterior clinoid process to the other and about a centimetre above the base of the skull, and with a retractor suitably placed there was seen projecting upward between the optic tracts what proved afterward to be a pituitary cyst. The cyst was opened and evacuated. The operation was devoid of any serious difficulty, and afforded a splendid exposure of the region of the sella turcica.

This method,<sup>1</sup> which is a modification of McArthur's, has certain advantages over the latter's, chiefly, in that the reflection of the osteoplastic flap from the frontal region admits of greater elevation of the frontal lobe and a correspondingly freer exposure of the deep-seated structures. This is a point

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<sup>1</sup> Since the reading of this paper this operation was repeated in a second case with equally gratifying results.

of the nasal bone down to the maxillary process. The eyeball is then drawn outward, the posterior part of the nasal septum and the sphenoidal septum are resected, and the hypophysis exposed. The disfigurement, Chiari claims, is slight, as only a small portion of the nasal framework is removed. Still a different method has very recently been devised by Biehl (*Zentralb f Chir*, 1912, Jan 6) in experimental work, consisting in a suprahyoid pharyngotomy. By drawing aside the soft palate with the tenaculum, the base of the skull covering the nasopharynx up to the bifurcation of the septum is bare. The soft parts are pushed aside, under wall of the sphenoidal sinus opened, floor removed, and hypophysis readily exposed. This gives a broader approach than most extracranial methods, and has been found by Biehl very successful on the cadaver.

With one and all of these transphenoidal operations, however, there are two serious objections. One, the inevitable risk of infection from the mucous membrane. This has proven the determining factor in almost all of the 30 fatal cases. The second objection is the rather contracted avenue through which one must work to reach the sella turcica, and difficulty in securing an adequate exposure of the sella turcica and contents. The variation in size of the sphenoidal cells is a disturbing factor. When of comparatively large dimensions exposure is not so difficult, quite as often one will find cells of small dimension, through which exposure is correspondingly contracted.

I am very much in doubt whether eventually the transphenoidal route will be the operation of choice, and although there are some conditions in which this method will have to be resorted to, I believe in the future preference will be given to the intracranial route through the anterior cranial fossa. With this in mind, I have endeavored to elaborate a technic which will make the exposure of the hypophysis as feasible as the exposure of other basal structures, such as the Gasserian ganglion. The procedure, which I resorted to lately, seems to me the safest and most rational that has come to my notice. The operation consists essentially in the reflection of an *en*stic flap from the right frontal region, in the removal *en* of the supra-orbital ridge as suggested by McArthur with a

portion of the roof of the orbit, later to be replaced, and in rongeur-ing away what remains of the roof of the orbit down to the optic foramen. With the elevation of the frontal lobe and the depression of the orbital contents, a free and adequate exposure is secured, and there remains only to make a short incision in the dura to lay bare the cavity of the sella turcica.

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of considerable importance. Secondly the portion of bone to be resected, including the supra-orbital ridge and a portion of the orbital roof, is of smaller dimensions. As this bone must be replaced for cosmetic reasons, its nutrition will be more readily supplied than the larger fragment of McArthur's operation, and necrosis is less likely to occur. This infrafrontal route deserves careful consideration in the selection of methods for hypophyseal operations. The presence or absence of a scar in the median line of the forehead is a matter of little consequence compared with the importance of selecting a method which ensures a minimum of risk to life with a maximum of exposure.

While it is still a matter of speculation which of the two methods, the extracranial or the intracranial, will become the conventional procedure, for the time being at least the operator should be influenced by the contour and conformation of the sella turcica. Ever since Oppenheim in 1899 discovered that enlargements of the sella could be reproduced by the X-ray and correlated with an increase in size in the gland itself, the radiograph has held an important place in the diagnosis and later in the mode of removal of tumors in the uncinate region. Thus, when the radiograph shows the sella deepened and encroaching upon the sphenoidal cells with a narrow orifice, access to the hypophysis from above, that is by one of the intracranial routes, is difficult and preference should be given to the transphenoidal method, in which the approach is made from below. When, however, the sella, whether deepened or shallow, has an enlarged orifice, showing its contents have encroached on the brain and not the sphenoidal cells, the transphenoidal method is practically impossible and one of the intracranial routes is indicated. In eleven out of fourteen deaths following a transphenoidal intervention (*Toupet, Revue de Chir.*, 1912, vol. XXXII, No. 6) autopsy showed that the tumor had encroached upon the intracranial space. It is very likely that the outcome in these cases might have been quite different had the intracranial method been applied.

Thus, we see there are cases in which the intracranial method is positively indicated and should be given preference. It gives a broader avenue of approach and lessens danger of infection

## POSTOPERATIVE THROMBOPHLEBITIS

BY ATHEL C BURNHAM, M D,  
OF NEW YORK CITY

POSTOPERATIVE thrombophlebitis and postoperative embolism are of such common occurrence that they enter into the experience of every surgeon. And yet, notwithstanding the advance in postoperative treatment during recent years, they are still so common, and the consequences may be so dire, that they remain the *bête noir* of the surgical profession.

It is the hope of helping to elucidate some of the problems of these associated conditions that is responsible for the report in some detail of the following cases taken from the records of the Presbyterian Hospital, New York City, covering the period from October, 1905, to January, 1912, inclusive. These cases are published through the courtesy of Dr. Joseph Blake and of Dr. Ellsworth Eliot, Jr., and I am indebted to them for permission to study these records.

More than sixty years ago Virchow drew attention to thrombosis, although he did not distinguish it from coagulation. To-day the meaning of the term has changed, and by a thrombus is meant the formation, in a vessel, of a solid mass or plug from the constituents of the blood, occurring during life. Coagulation is probably in no way responsible for thrombosis, in spite of the teaching of Wright and Knapp, who, in 1902, taught that post-typhoid thrombosis was due to the increased coagulability of the blood as a consequence of the high calcium content, following, and secondary to, the milk diet of typhoid convalescence.

The modern theory, now generally accepted, is in accord with the older theory of Eberth and Schimmelbusch. They believe that the blood-platelets play a prominent part in thrombosis and but little or no part in coagulation, while, on the other hand, fibrin and its progeners, although active in coagulation, play only a minor part in the formation of a thrombus. Blood-platelets, which, according to Bizzero, are normal constituents of the blood and number from 180,000 to 780,000 per cu. mm., are the originators of the typical thrombus. They may col-

lect about a foreign body, or, in consequence of a slowing of the blood stream, upon the damaged wall of a vessel—adhering to the vessel wall and to each other. This process is called *conglutination* and takes place only in the circulating blood, for, as Baumgarten has shown, there is no thrombus formation in the doubly-ligatured, excised vein. Following the formation of these nuclei, consisting almost entirely of blood-platelets, there is a rapid accumulation of leucocytes—mostly polynuclears—and following this, and possibly consequent to it, there is an accumulation of fibrin mixed with red cells. It is only fair to say that this theory has been disputed by competent observers, and there are still those who adhere to the original coagulation theory of Virchow, modified only by those changes which must take place in a process occurring in circulating blood. I have convinced myself, through repeated determinations, that there is no decrease in the coagulation time of the general blood in postoperative thrombophlebitis, and I have never seen any report of its occurrence in this condition.

According to Aschoff, a change in the character of the blood is a necessity for thrombus formation, while the location of the thrombus is determined by a slowing of the blood stream or by a widening of the vein, with the resulting eddy formation. To this may be added injury or disease of the vessel wall.

What changes take place in the blood? If we accept the modern theory of thrombus formation we do not have to do here with changes in the coagulation time, but with other changes less defined. Recently the viscosity of the blood has been suggested as the cause of the slowing of the blood and the consequent thrombus formation. To my knowledge the viscosity of the blood has never been tested in postoperative cases, although Bachman has shown that it is increased in infectious diseases, especially typhoid.

It has been fairly definitely proved that in those diseases in which the blood-platelets are increased thrombosis is common. In the present series the examination of the blood-platelets was made in only a few cases, and these cases are stated to show "very many" platelets. It is possible that in the future the determination of the coagulation time, the viscosity, and the

blood-platelets, if made in each case of thrombosis, may lead to important facts regarding this condition

That chemical changes may influence the formation of thrombi has been abundantly proved. It has been shown by Sahli and Egnet that thrombi did not form after the blood had been rendered non-coagulable by the injection of leeches extract, while, on the other hand, Schimmelbusch was able to cause the formation of experimental thrombi after destruction of the coagulation of the blood by the injection of peptone

Faucheux believes that the increased sodium content of the blood, due to a temporary insufficiency of the kidney, may be a predisposing cause, and cites one case where a large experimental dose of sodium chloride was apparently the direct cause of a thrombophlebitis. His work, however, is not convincing

The absorption of cellular material from the wound as a cause of phlebitis will be referred to later

Given the predisposing cause in the blood, what is necessary for the formation of a thrombus?

The commonly-accepted causes are two—slowing of the blood stream, with or without formation of eddies, and localized injury or disease of the vessel wall. The blood stream may be slow from local or general causes. When the circulation in the arteries is poor it is correspondingly diminished in the veins. Physiologically the flow in the veins is much slower than in the arteries. This is especially true in veins of lower extremities

Local causes of a slowing of the blood stream are seen in the anatomical relation of the left iliac vein and the artery and in the pressure on the veins (especially those of the pelvis) by new growths, a gravid uterus, tight clothing, etc

These causes, together with the varicosities, so common on the lower extremities—and indeed often the result of the above conditions—without doubt account for the predilection of the lower extremities, especially the left, to thrombophlebitis. Of 98 cases in the present series, 94 were phlebitis of the lower extremities, and of these 94 cases, 81 began in the left leg

Von Recklinghausen believes that the whirling or eddying is of more importance than the mere slowing. This motion takes place wherever the blood enters into a physiologically or

pathologically dilated portion of the vein, and is more pronounced when the general circulation is feeble. That these purely mechanical causes cannot of themselves cause thrombus formation is clearly evident, but that they can and do act as the exciting cause in many cases of thrombophlebitis is a well-recognized clinical fact.

Changes in the vessel wall may cause phlebitis. Injury to the vein without other known cause has been known to excite thrombus formation. Primary inflammation of the vein or infection spreading from contiguous tissues will excite a typical thrombophlebitis. Talke was able to cause thrombosis by the injection of staphylococci into the leg in the region of the vein, but not when they were injected directly into the vein. It seems to be the general opinion that the chronic changes associated with varicose veins, which combine several of the above-mentioned causes, are the usual exciting factor of thrombophlebitis.

However, it is unlikely that these degenerative changes are the cause in every case. If this were so, this disease should be much more common in patients past middle life, and absent or extremely rare in youth. In the present series 50 per cent were under 40 years of age, and, what is still more striking, 20 per cent were not over 20 years old.

*Infection*—Whether each and every case of thrombosis is, or is not, infectious is a question which the limits of this paper will not permit of discussion in detail. Klein, in a recent monograph on this subject, comes to the conclusion that thrombosis is not essentially an infectious process. Whether thrombosis can occur without infection or not is of scientific interest, but it is difficult to study a large number of cases without concluding that the greater number, if not all cases of postoperative thrombophlebitis are infectious manifestations.

Herdemann has called attention to the period of incubation and holds the entire process to be infectious in character. Klein argues against this and points to the afebrile cases as an argument against infection, but, as pointed out by Fromme, many slight rises of temperature may be overlooked, and, moreover, infection may occur without any febrile reaction whatever.

In the present series of 89 cases, 12, or 13.5 per cent, were clinically afebrile. These were generally the milder cases, the average time of confinement in bed being 15 days.

Lubarsch examined 215 cases and found that, in spite of the most exact technique, he could demonstrate organisms in only 20 cases. From this fact, and from the fact that thrombophlebitis occurs by preference in the veins of the lower extremities, Klein argues against the infectious theory of the disease. These arguments seem as futile as the argument that rheumatism and tuberculosis are non-infectious because no microorganisms can be demonstrated in the former, and because the latter occurs by preference in the apices of the lungs.

While no definite proof can be cited for or against infection, it is impossible, after examination of a large number of records of the recognized type of postoperative thrombophlebitis, not to feel that the process is the result of one of the milder, self-limited types of non-pyogenic infection. That the infection may be initiated by mechanical or chemical factors, or both, is doubtless true, but the course and symptoms of the disease are too typical of infection to allow of any other conclusion. The blood count was not made in every case, but, when made, it was always that of a mild infection, the leucocytosis disappearing with the fever. In 30 counts made on 24 patients the average leucocyte count was 14,700 and the average polymorphonuclear count was 87 per cent.

During the period studied there occurred a total of 98 cases of postoperative thrombophlebitis (excluding those cases due to evident direct extension from contiguous inflammatory areas) in a total of 11,655 operations. These operations represent 9,814 anæsthesics—the disparity being due to the fact that on some patients two or more operations were performed during the same anæsthetic (as, for instance, appendectomy and ventro-suspension). Of these 98 cases, 94 occurred in one or both legs and are the only ones in which a detailed study is made. In 5 of these cases records are incomplete, consequently in many calculations 89 cases only are analyzed. For convenience the analysis is made under these headings: 1 Occurrence 2 Cause 3 Onset 4 Duration 5 Complications

1 *Occurrence*—In 11,655 operations there occurred 94 cases of phlebitis, or 81 per cent. The various operations participated in these cases as follows

Operation	Total number	Males	Phlebitis Females	Phlebitis Total	Per cent
Appendectomy	2,670	13	28	41	1.5
Inguinal hernia	1,008	8	1	9	0.9
Operations on tubes	676	—	9	9	1.3
Ventro-suspension	411	—	3	3	0.7
Hysterectomy	293	—	12	12	4.1
Op. on ovaries alone	202	—	3	3	1.5
Ventral hernia	165	0	3	3	1.8
Femoral hernia	103	0	0	0	0
Miscellaneous	6,127	6	8	14	0.23

Hysterectomy was most frequently complicated by phlebitis, with ventral hernia, appendectomy, and operations on the uterine appendages next in the order named. It is interesting to note that in 103 cases of femoral hernia no case of phlebitis occurred. This fact seems of special interest in view of the intimate relation of the femoral vein to the field of operation. Of the miscellaneous operations, 6 were laparotomies, 2 were vaginal operations, 3 were kidney operations, and the remaining 3 were amputation of the breast, thoracotomy, and incision of cellulitis of the hand.

The following is a comparative table of the cases reported by different observers

Observer	Laparotomies	Thrombosis	Per cent
Friedman	2,766	87	3.6
Busse	1,107	18	1.6
J. Lang	1,326	19	1.4
W. and C. Mayo	1,788	18	1.0
Klein	5,851	70	1.2
	Births		
Klein	34,951	76	0.12

Sex seems to have some influence on the occurrence of phlebitis. In the present series 71.3 per cent were females. During the same period 53 per cent of the patients admitted to the surgical divisions of the hospital were women, so that the actual percentage of female cases would be a trifle smaller. Not including the gynecological operations, there were 40 cases in females and 27 cases in males.

Season had no influence Each month showed from 7 to 11 cases, with no tendency to seasonable variation

2 *Cause*—As has been pointed out, thrombophlebitis of the leg occurs most commonly after abdominal operations, but it may follow operations on distant parts of the body Of all operations, hysterectomy easily holds first place, probably because of the preceding pressure on the veins caused by the enlarged uterus All of the 12 cases noted on the list followed hysterectomy for fibroids, of which there were 212 operations Thus it is seen that phlebitis occurred in over 5 per cent of these cases and did not occur once in 81 hysterectomies for other causes, carcinoma, prolapse, etc ) We may therefore expect phlebitis once in every twenty cases of hysterectomy for fibroid tumors

Infection with the ordinary pus-forming organisms has been held accountable for phlebitis, but if this were true we should expect to find it exclusively a complication of operations upon purulent foci and rarely, if ever, after the so-called "clean operations" Of 94 cases, 32 had a purulent discharge, 10 were granulating, and 52 healed by primary union Of the same cases, 40 were drained and 54 sutured without drainage (two broke down after operation) Now, working on the principle that infection at the time of operation might be the cause of the phlebitis, the cases were studied with reference to the height of the postoperative temperature In 89 cases not markedly influenced by complications the average records are as shown below

Postoperative temperature	Cases	Onset	Phlebitis		Up after	Died
			Duration of tem- perature	Height of tem- perature		
			Day	Days		
Not over 100 6°	29	11th	6 2	101 1	19 3	1
Between 100 6° and 102 5°	48	13th	7 1	101 2	19	1
Over 102 5	12	13th	6 5	101 4	17	1

From the study of this table it is evident that the temperature after operation has little or nothing to do with the onset and course of the phlebitis

The cases were next analyzed with regard to the length of time the postoperative temperature lasted, the cases being



further subdivided into those with drainage and those without drainage The results are as follows

Postoperative temperature	Cases	Cases	Phlebitis				
			Onset Day	Temperature	Duration Days	Up after Days	Died
Lasted 2 days or less	29 { Drainage	7	14th	100 9°	4	14 9	
	29 { No drainage	22	11th	101 1°	5 9	22 4	1
Lasted 3 to 5 days	27 { Drainage	10	15th	100 8°	4 8	18 3	
	27 { No drainage	17	11th	101 1°	6 3	18 6	1
Lasted 6 days or more	33 { Drainage	23	13th	101 8°	7 8	21 6	1
	33 { No drainage	10	11th	101 4°	8 3	19 8	

It may be seen from these figures that the cases with drainage occurred from two to four days later than cases without drainage, and the cases in which drainage was employed were generally milder and ran a shorter course. This would lead to the hypothesis that the absorption of exudate from the wound predisposes to postoperative phlebitis. In other words, the absorption of the broken-down cellular elements and serous exudate, either with or without the presence of bacteria, causes such change in the blood as to lead to phlebitis and thrombosis. This interesting hypothesis is in accord with many of the known facts and warrants further study. The onset of the phlebitis is always at a period when some absorption has taken place, and usually occurs at a time when absorption is most active. In drainage cases the onset is usually later than in cases of primary union. In 9 cases in which the onset occurred on the 20th day or later, 8 cases, or 89 per cent, were drainage cases, and in 6 cases in which the onset was later than the 20th day there were no cases of primary union. The conclusion from these figures that in clean cases the liability to phlebitis is past by the 21st day, but that in drainage cases the danger of phlebitis persists for a much longer period, seems warranted.

The time of the operation, as well as the anæsthetic, seemed to have no influence on the occurrence of phlebitis or on the course or duration of the disease. The longest operation lasted 1 hour and 55 minutes, the shortest 6 minutes. Gas and ether were the anæsthetics in all but four cases, in which ether alone was used. Klein reports 560 gynæcological operations done under spinal anæsthesia with 10 cases of phlebitis, approximately the same percentage as in general anæsthesia.

Long confinement to bed has recently been brought for-

ward as the cause of postoperative thrombophlebitis Klein claims 50 per cent decrease since he has gotten his patients out of bed earlier In this series 70 cases began while the patient was still in bed and 19 developed after the patient had been allowed to walk around—surely not a good argument in favor of early walking Some cases developed even before the average date of onset in patients gotten up during first week

3 cases developed after getting up during the 1st week  
 9 cases developed after getting up during the 2nd week  
 5 cases developed after getting up during the 3rd week  
 2 cases developed after getting up during the 4th week

That it was not simply the getting up that called attention to the phlebitis is shown by the following

15 cases developed within 2 days after getting up  
 2 cases developed from 3 to 5 days after getting up  
 1 case developed on the 7th day after getting up  
 1 case developed on the 15th day after getting up

From these figures it is evident that if we are to stop phlebitis it is necessary to use other measures than merely to get our patients out of bed at an earlier date. On the contrary, the records would seem to indicate to me that the dependent position of the limbs is a factor in the causation of the process

3 *Onset*—The large percentage of the cases (82 per cent) began during the second and third week The earliest case developed on the 4th day, the latest on the 32nd day As has been noted, the onset was earlier in the “clean” cases

Average onset for all cases	122 days
Average onset for drain cases	136 days
Average onset for clean cases	110 days

The period from the operation until the onset of the phlebitis has been termed, by Haidemann, the “period of incubation,” and from its constancy he argues for the infectious character of the process

In 89 cases the onset occurred as follows

Period before onset 7 days or less	7 cases
Period before onset 7 to 21 days	76 cases
Period before onset more than 21 days	6 cases,

4 *Duration*—Of the 89 cases studied, 12 cases were afebrile and 77 cases ran a febrile course. Of the afebrile cases the shortest lasted 8 days and the longest lasted 26 days (average 15.5 days). In these afebrile cases those with drainage were regularly of shorter duration than the cases where the union was primary.

	Duration of fever	Up after
Afebrile cases	0 days	15.5 days
Febrile cases	7.5 days	23.2 days
All cases	6.5 days	20.0 days

Relapses were not uncommon, and, when they occurred, usually were due to the involvement of the other leg, which occurred seven times. In five of these cases the left leg was involved primarily.

5 *Complications*—Of the complications, may be differentiated those occurring before and those occurring after the onset of the phlebitis. Of the former, nephritis occurred twice, and gonorrhœa, syphilis, influenza, and scarlet fever each developed once before the onset of the phlebitis.

Following the process, embolism occurred in 10 cases, and pleurisy (possibly embolic in origin) occurred 4 times, pneumonia, malaria, tonsillitis, eczema of the affected leg, cerebral embolism, and hæmatemesis each occurred once. It may be noted that there was no case ending in suppuration. This would hardly be the case if any of the ordinary pyogenic organisms were responsible for the process. Of the 89 cases analyzed, 3 died. One death was due to pneumonia (possibly due to embolism), one death was due to cerebral embolism, and one was due to gastric hemorrhage on the 10th day following a gastro-enterostomy and two days after the onset of phlebitis.

Except for the cases of embolism, the cause of which is well recognized, no complication seemed to bear any noteworthy relation to phlebitis.

6 *Treatment*—The ultimate aim of all study of disease should be its prevention and cure. The treatment of post-operative thrombophlebitis has not received the attention and study due its frequency and the seriousness of its complications. Little or no attempt has been made to develop a plan

of treatment for this condition, although, reasoning from analogy, a specific medication might be obtained. Recently the advice is given to avoid phlebitis by getting patients out of bed earlier, and certain operators have reported less phlebitis since this procedure has been adopted as routine. The writer has already referred to this subject and is not so favorably impressed.

Bandaging or massage of the legs might be tried as a prophylactic, but I know of no cases where it has been practised as routine.

Wright advised the giving of lemon juice as a preventative. This was tried in four cases of the present series, but it was not given until after the onset of the phlebitis. Potassium iodide has been advised and the salicylates or citrates might be tried.

The records of the present series are given without comment. In themselves they are too few to lead to conclusions, but they may bring to light some other and better plan of treatment and at the same time cause the abandonment of less satisfactory forms of management.

The cases under consideration have been divided into several groups. In each case rest in bed was immediately insisted upon, although in some cases the patients had left the hospital and remained up and about until the swelling and discomfort brought them back to the hospital.

The other measures resorted to for the relief of the process and the course and duration were as follows:

Treatment	Cases	Duration of temperature	Up and about after	Died
Ice cap and elevation	29	8 days	20 days	1
Ice cap, ichthyol, and elevation	22	7 days	16 days	1
Ichthyol and elevation	18	6 days	16 days	1
Aluminum acetate dressing	6	6 days	24 days	1
Ice cap and elevation, lemon juice internally	4	6 days	18 days	0
Elevation alone	9	4 days	21 days	0
Menthol and elevation	1	8 days	29 days	0

In only one series was any medication given internally (except hypnotics and cathartics). Lemon juice was given in

four cases with fair results, but too few cases were thus treated to allow of any conclusion

It was frequently noted on the history that ichthyol gave almost immediate relief from pain. The other methods were less reliable

CONCLUSIONS —After study of these cases I feel that the following conclusions are justified

1 Postoperative thrombophlebitis is an infectious disease, a definite entity in some way connected with the absorption of material from the wound

2 It is preceded by a slowing of the blood stream, and by local and general disease of the vessel walls

3 It occurs at an earlier date in "clean" cases than in drainage cases

4 Rest in bed seems to be the only therapeutic measure capable of exerting any marked influence on the severity and course of the disease

5 Ichthyol seems to have a direct and constant influence on the local pain

6 Internal medication deserves a more thorough trial than it has had previously

Some of the above conclusions are personal, most are in accord with other observers, in them an effort has been made to bring out the salient points and to add these cases to the literature in order to hasten, if possible, the final solution of the problem

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# MULTIPLE MYELOMATA, WITH NUMEROUS SPONTANEOUS FRACTURES AND ALBUMOSURIA

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MYELOPATHIC albumosuria is a rare disease, of which only about sixty examples have been recognized since Bence-Jones first described it before the Royal Society in 1847. Upwards of forty of these have been summarized in papers by Parkes, Weber<sup>1</sup> and Paget Moffat,<sup>2</sup> who published their papers in 1903 and 1905, respectively, while references to the later cases will be found at the end of this article and more fully in the Transactions of the Royal Society of Medicine appended to the article by Weber and Ledingham.<sup>3</sup>

Although Bence-Jones described the characteristic albumosuria in 1847, it was only as recently as 1898 that bone lesions were recognized during the patient's life as an essential part of the disease. This was in the case of a man of 70, a patient of Dr Bradshaw, of Liverpool. The recent exhaustive papers by Bradshaw,<sup>4</sup> Weber and Moffat, together with the voluminous literature dealing with the subject chiefly from the chemical and cytological points of view, would make it quite superfluous for me to give a general review of the subject. I will therefore merely give an outline of the chief features of the disease in order that the peculiar and distinctive characters of my case may be emphasized.

It is easy to construct a simple picture of the type of disease as hitherto described, because the great majority of the cases have so very closely resembled one another. In its general characters the disease resembles osteomalacia, with which, no doubt, it has often been confused. That is to say, it is a profound constitutional affection which is accompanied by severe, deep-seated pains and bony deformity and leads to a rapidly fatal issue within a period of about two years. It differs from osteomalacia in the following respects. It affects men much more frequently than women, it presents in the urine the char-

acteristic Bence-Jones albumose, the bones are the seat of a definite cellular growth resembling a sarcoma, and are not merely softened by the absorption of the calcareous material, and the chief bones affected are the vertebræ, sternum, and ribs, rather than the pelvis and limb bones

In many cases there has been a diminution of the red blood-corpuscles, with an increase of the white, but both these changes have only been of slight degree, and it is quite uncertain whether they are primary or secondary. Gastro-intestinal disturbances have so frequently been recorded that they must be considered as a part of the disease. In some they are the earliest symptoms, and in others they appear to be merely a late complication. Both fractures in the ordinary sense of the term and bone tumors have, in the majority of the cases, been rare or inconspicuous. This is due, no doubt, to the fact that the chief seat of the disease has usually been the bones of the thorax. In the case of Inglehart, Hamburger, and Simon<sup>5</sup> a woman of 49 had a spontaneous fracture of the left femur a few days before her death. A woman of 37 (Jochman and Schumm<sup>6</sup>) fractured both her thighs. In Anders and Boston's second case, a man of 43 had broken his leg in a bicycle accident three years before the onset of the disease. Weber and Ledingham<sup>3</sup> relate the case of a woman of 65 who was found at the autopsy to have a united fracture of the humerus. The case of Bruce, Lund, and Whitcombe<sup>8</sup> is the only one that can fairly be described as a case of multiple spontaneous fractures. It was a woman of 51 who in 1902 and 1903 broke the left femur, left clavicle, and left humerus. In many of the other cases there occurred fractures of the ribs or sternum, which were often only discovered at the autopsy. It is thus rather curious that, although the disease is so much commoner in men than women, the latter present the majority of the cases in which fracture of the limb bones have occurred.

The case which I am about to describe is quite unique in the following respects. The length of the history is twelve years, and at the present time the patient appears to be in good health, the disease being quite stationary. Moffat<sup>2</sup> speaks of the disease as being one in which the prognosis is "utterly bad,"

there being only one case—that of Kahle—in which the symptoms had lasted as long as eight years. The majority of patients have died within two years, while many have only survived the recognition of their complaint a few months. And, lastly, the number of fractures and the development of large, conspicuous bony tumors in my patient are in marked contrast to the history of all the other cases.

Although great and minute attention has been given to the histology and chemistry of the disease, there has been very little published as to its appearances by the Röntgen rays, and I have, therefore, paid special attention to this point and reproduce here skiagrams of most of the affected bones.

*History of the Illness*—Mr P, aged 39, clerk. *Complaint*—Multiple spontaneous fractures and swellings of the bones.

*Family History*—Father alive, aged 67, has suffered from double optic neuritis for the past 12 years. Mother died four years ago from heart-disease. Lost several brothers and sisters in infancy. One brother well and robust, aged 41. Four sisters all well.

*Past History and History of the Present Condition*—Twenty years ago he used to be a "perfect Sandoz." He then measured 5 feet 4 inches and weighed 8 stone.

1900—After a period of indefinite illness, in which the doctor said he had "consumption," an attack of gastritis occurred, with vomiting of food but not of blood, also severe pain. Weight fell to 92 pounds. He had peptonized food for six months. He completely recovered health and strength under treatment.

1901, May—He had for some months been suffering from "rheumatic pains," when he slipped on a banana skin and fell, breaking the *left tibia*. This took about nine months to consolidate, but otherwise there was nothing which suggested that the fracture was of an exceptional nature.

1902, January.—On raising a window sash in a railway train which was stuck fast, the window suddenly gave way and hit him on the left of the lower jaw. This was followed by a numb feeling but not much pain. A fleshy growth of the gums made its appearance near the place struck, and the jaw became gradually much thickened. The growth in the gums sprouted out cherry-like outgrowths, which from time to time were absorbed or burst, discharging thick dark blood and stringy mucus. This sometimes amounted to as much as a wineglassful at a time. The



jaw growth increased in size until 1909, but since then it has decidedly diminished and the fleshy part of the growth disappeared

1904 — He suffered from severe "muscular rheumatism," and large bruises came out on the right thigh without any apparent cause. He was at this time very liable to fall if he encountered the slightest obstacle

February, 1904 — The pain had been very severe in the left thigh from November, 1903, to February, 1904, when the *left femur* broke from the strain of muscular exertion. It healed in nine weeks under splint treatment

April, 1904 — When just recovering from the last fracture, on moving to an arm chair, the *right femur* fractured. It was kept about ten weeks in splints, and was well by the end of the year

1905 — On February 4, while getting about on crutches and swinging the left leg, the *left tibia* broke again at the old place. It was not set, but allowed to heal with marked angular displacement. This occurred in about three weeks

February 8, 1905 — Three days later the *right forearm* broke under similar circumstances

February 25, 1905 — While lying in bed, holding a book, the *left elbow* broke with great pain, and the present enlargement developed to almost its full size within one week

1907 — In February the neck of the *left femur* broke when he was in bed, when he was drawing the leg up beneath himself

1908 — The base of the *second right metacarpal* became swollen. The peculiar spatula shape of the digits he has had for a long time he attributes to the exercise of typewriting for many hours every day

*Present Condition* (Fig 1) — The patient is a very nervous and alert man, with an unhealthy, sallow complexion. Apart from his crippled condition and nervous temperament, he is healthy and cheerful. He cannot walk at all, even with crutches, because the left leg is so deformed that he cannot put the sole of the foot to the ground when standing, and the arms are so deformed that he cannot use crutches, and, further, he is naturally very anxious lest he should at any moment slip in a way which might cause a fresh fracture

*The Jaw* — The whole of the left side of the jaw is thickened so as to form a conspicuous smooth tumor. Viewed from the inside, the jaw is deeply excavated, looking as if a large medullary tumor had been scraped out from its interior. The surface of this excavated part is smoothly covered by scar tissue. The situ-

FIG 2



FIG 1



Photograph of the patent taken in  
1911



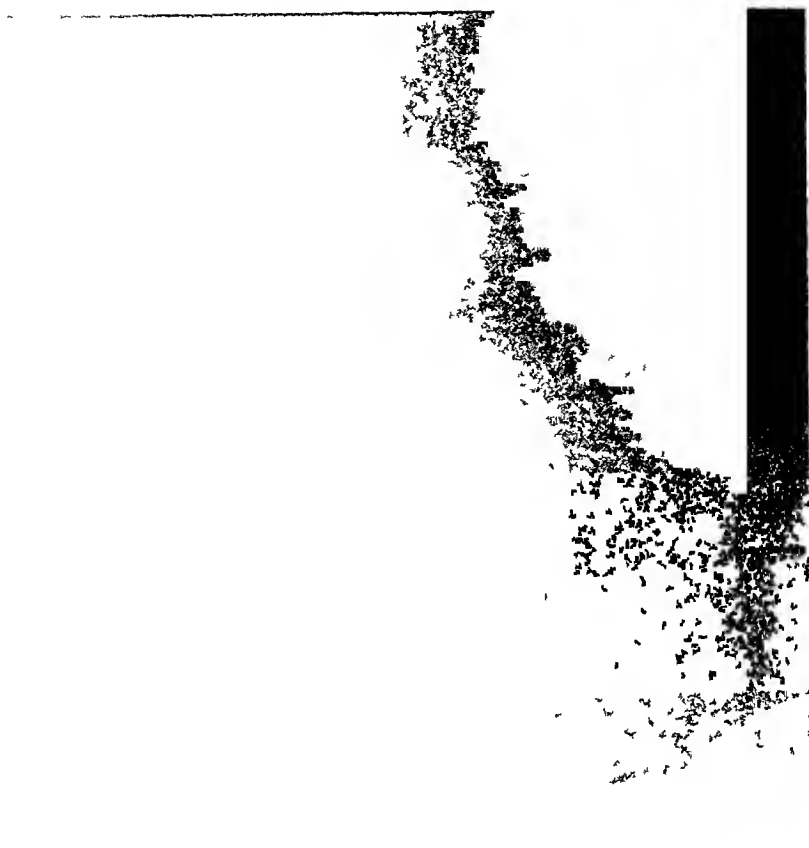
Photograph of left arm (fracture 1905) taken in 1911. The upper protuberance is the dislocated head of the radius the larger mass is a bony tumor of the upper end of the ulna



Skiaograph of the left elbow (Fracture 1905)

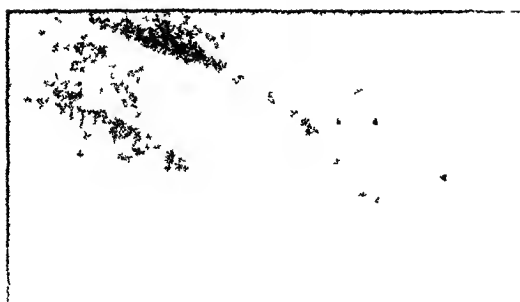


FIG 6



Right femur (fractured in 1904)

Fig 9



Left leg and foot T of fractures, 1901, 1905



ation of the tumor was evidently the whole left body of the mandible, and all the teeth on that side have been lost. The outer surface of the jaw mass is hard and insensitive.

*The Right Forearm* (Fig 2).—The radius is the seat of a well-defined tumor, 8 x 4 cm., rather above the middle of its shaft. The appearance of light, bubbly areas in the skiagram is well marked in the tumor, and extends up the shaft as far as the head of the bone. The ulna presents a gentle, even curve in order to accommodate itself to the mass in the radius, but, nevertheless, there is very little rotation possible in the forearm, the hand being held in full pronation.

*The Left Forearm* (Figs 3 and 4) —The elbow is the seat of a great deformity. A large globular tumor 10 cm. in diameter occupies the upper end of the ulna. The radius is completely dislocated from the humerus, and its head forms the projection so conspicuous in the illustration. In the Röntgen picture the ulnar tumor is dense and remarkably well defined. The radius shows one area of expansion and thinning about the middle of its shaft which is possibly an area of disease. The elbow-joint is freely movable, though the range of its mobility is limited to about 90 degrees. Supination is impossible.

*The Hands* (Fig 5) —The tips of all the digits are flattened and spatula shaped, the thumbs being most conspicuous in this deformity. There is a fusiform swelling of the second right metacarpal. The X-rays show a finely vacuolated tumor occupying the shaft of the second right metacarpal, some vacuolation without deformity in several of the carpal, metacarpal, and phalangeal bones, and marked atrophy of the terminal phalanges, especially those of the left thumb and index-finger.

*The Right Femur* (Fig 6) —The right thigh is shortened, deformed, and adducted. There is a large and irregular thickening round the hip-joint, the movements of which are very much restricted. In the skiagram the whole of the head and neck of the femur is seen to be occupied by a tumor, the shadow of which has a coarsely vacuolated appearance. The upper end of the bone is bent in the shape of a crook, giving the effect of an extreme coxa vara. In the concavity of the curve is a separate piece of bone which looks as if the lesser trochanter had been detached.

*The Left Femur* (Fig 7) —The head and neck are affected in much the same way as on the right side, though not to quite the same degree. Below the position of the small trochanter there is a periosteal thickening and indentation suggestive of an old



fracture The whole of the shaft of the femur is occupied by large vacuoles, with atrophy of the dense bone, and just below the middle is a badly united fracture

*The Left Shin* (Figs 8 and 9) —The left lower leg is greatly deformed, being bent backwards almost at a right angle and having at the angle a large, globular tumor, the skin over which is marked by large veins The X-rays show that this tumor is composed of a large portion on the tibia and a smaller one on the fibula, the whole being 13 x 10 cm in diameter

*The Left Calcaneum* (Fig 9) —A tumor 12 x 7 cm occupies the left heel, springing from the calcaneum and projecting chiefly on outer side of the foot All of the tumors in the foot and leg are sharply defined, and their shadows show well-marked vacuolation

*The right tibia* shows no external deformity, but in the skiagram it is evident that the whole bone is thickened, this being caused by an increase of the medullary part and a thinning of the dense part of the shaft

*The Ribs* —The sixth and eighth ribs show quite definite tumors on the X-ray plate, though these are not noticeable by palpation Both lie just behind the angle, that on the sixth being sharply marked and about 5 cm by 2 cm, while that on the eighth is merely a bead-like enlargement of the bone The other bones of the skeleton are normal in their X-ray appearances

*Notes on the urine and blood* by the pathologist, Dr Scott-Williamson —The urine, which was voided frequently, amounted to 1,200 to 1,500 cc daily It contains a precipitable protein, amounting on an average of four days to 5.2 per cent, equal to 63 grammes per 24 hours The precipitate was recovered by treating the urine with 96 per cent alcohol and purifying by repeated solution in water containing a trace of sodium carbonate and reprecipitation by alcohol, treating with ether and drying over sulphuric acid The ash was not estimated.

The precipitate so purified was insoluble in distilled water and only very sparingly in normal saline, readily soluble in water containing a trace of sodium carbonate Careful neutralization keeps the protein in solution In the presence of a trace of acid the precipitate appears at a low temperature and disappears on boiling The temperature at which the precipitate appears varies from 60° to 43° C as the concentration of the salt is increased Tested with lead acetate, the precipitate contains an appreciable quantity of sulphur in loose combination Bail's orcin test indicates the presence of a carbohydrate group in the molecule

There seems little doubt that this protein is the "Bence-Jones body" In the urine the typical precipitation at low temperature is demonstrable, but it is impossible to appreciate any clearing upon boiling. The urine contains some casts and pus-cells and other indications of cystitis. The blood shows no quantitative or qualitative abnormalities of its cell constituents.

There can be no doubt that the above is a true case of myelopathic albumosuria, but at the same time it presents so marked a contrast to all other described cases as to form quite a separate clinical picture. The twelve years' history of his complaint may be divided into three periods. For one year he suffered from a severe constitutional illness, of which gastritis was the chief symptom, then for six years (1901-1907) he had a long succession of bone-breakings, seven times fracturing one or other of the long bones, in addition to developing tumors of the jaw, metacarpus, and tarsus. But for the last five years he has had no further developments either of fractures or tumors, he is free from pain, and, apart from his wretchedly crippled condition, he feels that he is stronger and in better health than he has been since 1900. The blood condition, as judged by the enumeration of its cells, is normal, but, on the other hand, the albumosuria remains well marked.

From a surgical point of view the case is very interesting, because it shows that the fractures, although brought about by the development of tumors of the bone-marrow, have always united firmly. His greatest disability has been caused by the neglect to retain the left leg in good position after it had broken the second time. I should be inclined to correct the angular deformity of the left leg by an open operation, but, owing to some one having suggested that this might reawaken the disease, the patient is not willing to submit to the risk.

I do not feel myself competent to discuss the essential nature of this mysterious disease, or the various pathological theories which have been put forward to explain it. Whether it is a blood disease allied to leukæmia, or a sarcoma, whether the changes in the bone-marrow are the cause or the effect of the altered metabolism, are all points fully discussed in the learned papers to which I have referred. But the case I have related seems to prove certain points quite conclusively. The whole picture is perfectly typical of an infective disease, of chronic course, attacking chiefly the skeletal tissues, and in time wear-

ing itself out and leaving nothing but the marks of its old ravages on the affected bones. First, there are all the signs of a constitutional infection, *ie*, a prostrating illness, severe vomiting, rapid loss of flesh, and diffuse rheumatic pains. The disease then becomes localized in the tissues most vulnerable to it, *viz*, the bones, and these break one after another when they have been unduly weakened. But there seems to have been a good power of local reaction, and massive bone scars have been formed as the result of this local resistance to infection. And now the infection is at an end, or at least quiescent. Syphilis, tuberculosis, and actinomycosis are examples of similar diseases of known microbic origin. And, lately, other forms of sporotrichosis, chiefly affecting the bones, have been described by French authors which make it still more likely that this is really an infective disease. It is quite clear that in the ordinary clinical meaning of the term the disease is not a sarcoma. In this case, at any rate, the disease has been of twelve years' standing, and now appears to have undergone a spontaneous arrest. It seems to me quite impossible to settle this question by histological methods. It is true that many distinguished authors have positively declared that the tissue of the bone tumors is that of a round-celled sarcoma. But one may well ask whether there is any essential difference between the structures of such a sarcoma and that of the granulation tissue which is formed in reaction to bacterial infection.

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# TUBERCULOSIS OF THE BREAST.

BY CHARLES A POWERS, M D,

OF DENVER.

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MY first case of tuberculosis of the breast was reported to the New York Surgical Society, May 23, 1894 (ANNALS OF SURGERY, August, 1894) It concerned a woman of twenty-six years on whom a radical operation was performed. When this patient was examined three years afterward the region of the scar was free, but she was in a condition of advanced pulmonary tuberculosis to which she succumbed in a short time. At the time of this original report but 34 other authentic cases could be gathered from literature <sup>1</sup>

My second case was published (ANNALS OF SURGERY, January, 1897) a little less than three years later, at which time I was able to find but four additional instances This patient was a woman of forty years, referred by Dr. P V Carlin, in whom a clinical diagnosis of cancer of the breast was made, a pathological report of tuberculosis was rendered by the late Dr. H C Crouch This patient remains well

I am now able to lay before you two additional cases, making four in all The first of these supplemental cases concerns a young woman of twenty-three years, a patient of the late Dr J A Wilder In this case a slowly growing, rather doughy mass was found in the lower outer quadrant of the left breast A fistula which discharged thin pus was present\* The breast and axillary glands were removed, together with the fascia overlying the large pectoral muscle Smooth healing occurred Dr Wilder reported both breast and axillary

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\* Read before the Denver County Medical Society, October 15, 1912

<sup>1</sup> December 7, 1912, I am this day in receipt of a communication kindly sent by Dr Louis B Wilson, of the Mayo Clinic, in which he says "A somewhat careful search of our records here shows that since the laboratory was opened, January 1, 1905, there have been but two cases of tuberculosis of the breast, though during the period over one thousand cases of tumors of the breast were operated upon"—C A P

glands as showing tuberculosis This young woman was well when last seen, some three years after operation, but I am unable to find trace of her at this time

My fourth case concerns a girl of fifteen years, a patient of Dr. P V Carlin The mother of this girl first discovered a slight lumpy condition of the right breast and axilla in October, 1911 She paid but little attention to it The condition slowly increased, fistulæ formed The girl lost in weight and in strength In March, 1912, she consulted Dr Carlin, who kindly referred her to me On examination I found a diffuse, irregular, doughy mass in the upper outer hemisphere of the right breast The entire axilla was occupied by large, hard masses Three discharging fistulæ were present The breast mass seemed, clinically, to involve somewhat less than the outer upper half The lungs were free A thorough operation was done at St Joseph's Hospital, March 25, 1912 Through a peripheral incision the upper outer half of the breast was removed, together with the fascia from the pectoralis major muscle On cut section of the breast tissue it seemed as though the incision were through a healthy part of the gland, and for cosmetic reasons the inner portion of the breast, together with the nipple, was left I am well aware that a macroscopic examination was by no means conclusive, but this operation was on a young girl and I earnestly desired to mutilate her as little as possible The tendon of the pectoralis major was divided and the subclavian region and axilla were thoroughly cleared of a very large mass of glands These were adherent to the vein, the dissection was difficult and tedious The wound was closed with a cigarette drain and prompt healing took place Dr Ross C Whitman, professor of pathology in the University of Colorado, makes the following histological report

Tubercular lesions are found in the skin covering the breast, in the underlying tissues, and in the superficial portions of the glandular structure, but do not extend deeply into the gland Where the gland is involved the lesions apparently occupy the seat of a former group of gland acini, which have been destroyed by the tubercular process The fibrous stroma is normal The lesions consist of groups of "epithelioid" cells and giant-cells surrounded by a zone of fibroblasts with capillaries and newly formed collagen In and about the tubercle are remnants of glandular structure The axillary lymph-glands are frankly tubercular

Dr Carlin administered small doses of tuberculin to this patient for several months after the operation She has gained

17 pounds in weight (6 months), she has gained materially in strength, she feels well in every way. The regions of the removed breast tissue and of the axilla are free. There is no evidence of tuberculosis elsewhere. The preservation of the inner portion of the breast and of the nipple give a contour which is and will be of no little importance. I strongly feel that the entire gland should generally be removed in breast tuberculosis, but in this instance I am quite willing to run the risk of a further operation, although I doubt whether the necessity will arise. In this case it is probable that the condition first appeared in the axillary glands and extended thence to the breast.

The first notable observation on tuberculosis of the breast was made by Richet in 1880 (*Gazette des Hôpitaux*, 13 Mai, 1880). Since this article a not inconsiderable number of important contributions have been made. V. Cornil (*Les Tumeurs du Sein*, monograph, Paris, 1908) discusses the pathology in a very thorough way. He says that to the unaided eye the anatomical form of these lesions is variable. The tuberculosis may actually appear like small semitransparent granulations, often with a caseous centre and scattered over a more or less considerable portion of the gland. This type is described by Ziegler as acute tuberculosis. More commonly, however, the lesions appear as follows. On palpation, in the living subject, the gland presents one or several, more or less voluminous, superficial, subcutaneous or deep, hard nodules, at the level of which the skin is thickened and congested when the lesion is directly beneath it. These nodules are located in the gland or at its periphery, sometimes at quite a distance from the nipple. In long standing lesions an orifice may have formed spontaneously or after an incision, this granulating fistulous opening leads to a deep, purulent focus lined with fleshy granulations. A surface section shows grayish, rounded nodules composed of inflammatory tissue, semitransparent, from the size of a hempseed to that of a small pea, disseminated in a portion of the gland and caseous in their centre. These nodules are isolated, more or less distant from each other or confluent. Their caseous, yellowish centre, being lifeless, has a tendency toward disintegration.

infiltration with serum or pus, and transformation into small cavities. In cases of massed nodules the confluence of their cheesy portions and disintegrated areas gives rise to small or large irregular, angular cavities, filled with pus, their walls being lined with granulations. Under these conditions a tuberculous abscess empties through a fistula with a granulating sinus, after it has opened spontaneously through thickening and perforation of the skin, or has been punctured by the operator. The naked eye appearances, as well as the sequelæ of tuberculosis, are practically identical, no matter what organ of the body is affected, be it a gland, the testicle, the skin, or the breast. Later on there follows degeneration of all of these elements, and one or more acini with necrotic cells take on a caseous, dry appearance, due to the absorption of the liquid contained in the degenerating cellular exudate. The constituents of the latter are small, fragmentary, with non-stainable nuclei which are reduced to finely granulated nuclei. As to the formation of the giant-cells, Dubar (*Thèse de Paris*, 1881) suggests that they originate in the interior of the culs-de-sac in consequence of the accumulation of leucocytes in the glandular cavities, followed by the conglomeration of the protoplasm of these cells in the centre of the cavities. This mode of genesis of the giant-cells is very questionable. Although a large number of giant-cells are undoubtedly found in tuberculosis of the mammary glands as in all new formations of this kind in man, at the time when they are encountered the process is sufficiently advanced for the membrana propria of the gland to have disappeared. Personally, the author has never seen a cul-de-sac with a recognizable membrane containing a giant-cell, except in experimental tuberculosis of the mammary gland.

The extra-acinous milk-ducts of all sizes are involved at the same time. Their peripheral connective tissue is the seat of leucocytes, their epithelial cells become larger than normal and frequently present several nuclei. This increased epithelium, mixed with the leucocytes which have passed through the membrana propria of the canal, forms a mass which fills and distends the cavity and in its turn becomes caseous. The

epithelial cells then present a hyaline protoplasm and their nuclei no longer take the stain, the leucocytes are broken up and their nuclei crumble into fine, stainable granulations, like nuclein. Tuberculous granulations project at the internal surface of the milk-ducts, the membrana propria of which is finally destroyed. These granulations possess variable numbers of giant-cells, surrounded by inflammatory tissue containing mononuclear leucocytes. The secretion of these tuberculous granulations drops into the cavity of the milk-ducts, where it collects in the form of leucocytes. The milk-ducts are changed into actual cavities with tuberculous walls. The process may be compared to the familiar course of peribronchial tuberculosis, with formation of small pulmonary cavities at the expense of the bronchioles. These small cavities give rise to progressive inflammation in their surroundings, and underneath the skin they finally invade and thin out the dermis, project under the epidermis and destroy it, opening externally and forming fistulæ or sinuses with the tuberculous walls of all subcutaneous tuberculous abscesses. In these acute and subacute cases, of a certain severity, more or less bacilli are encountered. A severe generalized tuberculosis was found by the author in the sections of a breast which had been removed by Nélaton and sent for examination as a doubtful tumor. The milk-ducts had a swollen and ulcerated internal surface and were lined with tuberculous granulations, giant-cells being surrounded by mononuclear leucocytes. In mammary tuberculosis the axillary glands are also often tuberculous<sup>1</sup>. This glandular tuberculosis is either subsequent to that of the mammary gland, or it may be primary, the gland being invaded secondarily. In the first case it is necessary to assume that the lymphatics have carried the bacilli or infectious agents from the breast to the glands, following the regular course of the lymph. In the second case, where the axillary glands are impermeable, the lymph is supposed to stagnate between them and the mammary gland, the infection taking a retrograde course to the breast by continuity. The histological

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<sup>1</sup> Almost invariably—C. A. P.



examination of fully developed tuberculous nodules shows tuberculous granulations composed of a cellular tissue infiltrated with leucocytes and with giant-cells in the centre of the granulations, large cells usually surrounded by epithelioid cells. The findings differ in no way from the ordinary. Tubercle bacilli are rare. Extensive sections, in recent cases, show inflammatory irritation of the connective tissue more or less infiltrated with polynuclear or mononuclear leucocytes, in the midst of the cellular tissue are seen acini undergoing tuberculous changes. The mode of development of the lesion can be studied in these acini. When the process is very acute, the polynuclear leucocytes invade the intra-acinous cellular tissues, and later the culs-de-sac themselves where they collect between the epithelial cells and in their central lumen. In subacute invasions the mononuclears surround the culs-de-sac, which present an intact or slightly thickened *membrana propria*. At the same time the epithelial cells become more voluminous and numerous, soon, however, leucocytes penetrate through the membrane, destroying it and accumulating in the interior of the glandular culs-de-sac where they mix with the epithelial cells. The result is a considerable enlargement of the acini and culs-de-sac.

In mammary tuberculosis of a chronic course, the tuberculous granulations are isolated and disseminated rather than confluent, but nevertheless perfectly characterized by their giant-cells as well as by the epithelioid cells and peripheral lymphatics. Cornil examined a case of this kind operated upon by Berger, in it the blood vessels, lymphatics, and epithelial cells were at the height of their physiological activity.

Cornil received fragments of infected udders from Nocard for microscopical examination. All of the constituents of the gland were seen to be inflamed and undergoing a very active tuberculization. Although the injection had penetrated only into the milk-ducts and the culs-de-sac by which these ducts terminate in the acini, the connective tissue was invaded no less than the gland. The glandular culs-de-sac were filled with enlarged epithelial cells and with leucocytes mixed with the

milk, the connective tissue prevented the same leucocyte infiltration, and bacilli were found in the cellular tissue as well as in the contents of the glands. Later on giant-cells were demonstrated in the culs-de-sac as well as in the connective tissue.

These experiments of Nocard seem to have put an end to the controversy which had been raised concerning the development of mammary tuberculosis in women, some contending that it develops primarily in the connective tissue where it becomes localized, others claiming that it is of glandular origin and limited to the gland. From Nocard's experiment it appears that the bacilli which have been introduced into the glandular cavities subsequently spread outside of these; it cannot well be otherwise when the connective tissue is the primary seat of the infection.

Recently an analogous experiment was performed by Nathan Larrier, who injected a small amount of a virulent culture of tubercle bacilli by means of a Pravaz syringe into the middle of a nursing guinea pig's udder. He injected, without distinction, the cellular tissue or the glandular parenchyma, or both together. The warm milk in the gland, at the instant of its production, was found by him to be the best and most rapid culture medium for the bacillus. At the end of eight to ten days the microbe was recovered from the secreted milk, and on the twelfth day the histological examination showed the presence of tuberculous lesions of the gland. Nathan Larrier concludes from these findings that the inoculation of a liquid that is suspected of being tuberculous into the udder of a nursing guinea pig is the most rapid method of diagnosis of tubercle bacilli. As a matter of fact, a positive or negative outcome is obtained at the end of at most ten or twelve days, while it is necessary to wait a month after subcutaneous or interperitoneal inoculation of the same animal.

Abraham (*Tuberculose Primitive du Sein, Thèse de Paris*, 1910) says that tuberculosis of the breast is a relatively rare disease which attacks women from puberty to the menopause. The personal antecedents of the patient, pregnancy, lactation,

preceding diseases of the breast, occupy an important place in the etiology of the mammary tuberculosis, which in certain cases may represent an isolated and primary manifestation of the disease. The infection may occur by the blood route, by the lymphatic route, or by way of the milk channels.

From the anatomical as well as clinical point of view, mammary tuberculosis appears under two principal forms—the disseminated and the confluent. The latter is by far the most common. Between these two extreme types various intermediate forms may come under observation. While the diagnosis is not especially difficult in certain cases, it may become practically impossible in others. The condition may be confused with any solid or liquid tumor of the breast. The prognosis as to life is variable, but the gland itself is generally doomed. When tuberculosis of the breast attacks an individual already suffering from visceral lesions, the prognosis is governed by the general condition. When, on the other hand, tuberculosis of the breast is the only manifestation of the disease, it is not likely to lead to a very rapid infection of the organism.

An interesting observation is made by Duvergey (*Journal de Médecine de Bordeaux*, No 53, 1911, p 841), who presented before the Bordeaux Anatomico-clinical Society meeting of October 23, 1911, a case of mammary tuberculosis, by retrograde lymphatic infection in consequence of an infected wound of the hand, in a woman forty-eight years old. The patient's left hand, which had a small abrasion at the dorsal surface of the second metacarpal bone, became infected with tuberculous material in the handling of contaminated bed linen in a sanitarium. Some months later, after having lost considerably in weight, the patient began to suffer from a large axillary abscess. This was followed by the appearance of an abscess of the breast with supra- and subclavicular abscesses. The tubercle bacillus had accordingly penetrated through the wound of the hand, infecting the axillary glands by the lymphatic route and giving rise to a local tuberculous adenitis, continuing along the lymphatic route it led to the formation of abscesses.

in the integument and superficial portions of the mammary gland, next, the supraclavicular glands became infected and began to suppurate, finally the apex of the left lung was invaded, perhaps also by the lymphatic route

Tuberculosis of the breast is known to occur by way of the lymphatics, the starting point being in the axillary glands, the above observation belongs under the same heading

Ingier (*Mastitis tuberculosa obliterans*, Virchow's *Archiv*, vol cxi, 1910, p 217) reports a case of tuberculous mastitis in which obliteration of the excretory ducts of the mammary gland had occurred through intracanalicular tuberculous granulations. Tuberculosis was at once suggested by the peculiar structure of the granulation tissue and the appearance of Langhans's giant-cells. This assumption was confirmed by the demonstration of tubercle bacilli in the smear specimen of fresh material

Although primary tuberculosis of the breast has been described in numerous cases it is generally considered a relatively rare disease of that organ. Bindo de Vecchi, in 1902, contributed a critical review of the cases reported up to that date (*Extratis della clinica chirurgica*, No 8, 1902). Including a personal observation, he found altogether 78 cases of primary tuberculosis of the mammary gland. None of these cases seems to have been due to intracanalicular tuberculous inflammation leading to obliteration of the excretory ducts, as in the author's observation. A second case of mastitis tuberculosa obliterans was observed by him a short time later, while a third case represents a more fibrous form of mammary tuberculosis.

Stromberg and Kasogledow (*Tuberculose der Brustdrüse*, *Russ Archiv für Chirurgie*, 1909, *Jahresbericht für Chirurgie*, xv, 1909, p 526) give three forms of tuberculosis of the mammary gland: the diffuse, confluent form, solitary cold abscess, and the sclerotic, scirrhus-like form. The diagnosis of the last named form meets with difficulties, because the pieces obtained by an exploratory incision can hardly be differentiated from carcinomatous scirrhus in the histological

examination<sup>2</sup> In at least 50 per cent of cases the mammary gland is not alone affected, there are other foci of tuberculosis

Braendle (Ueber die Tuberkulose der Brustdruse und die Dauerresultate ihrer operativen Behandlung, *Beitrage zur klin Chirurgie*, vol 1, 1906, p 215) reports on eleven patients who came under treatment in the Tübingen surgical clinic, service of von Buins All had borne children and seven had nursed them None of these patients had a demonstrable affection of the lungs, two had tuberculous lymphomata other than axillary, while the axillary glands were involved in 85 per cent of the cases The confluent form of mammary tuberculosis was represented throughout In ten of the cases amputation of the breast with evacuation of the glands was done, the wounds healing smoothly within from 8 to 14 days One case healed under excochleation and drainage Concerning the permanency of the cure, the author was enabled to investigate 16 cases These cases included 15 cures, there was one recurrence in a case which probably originated in a costal caries The period of observation comprised from 1 to 19 years Three patients who had remained free from local recurrence died from pulmonary phthisis Subsequent infection of the other breast was not observed in any instance According to these experiences, with a figure of 92.75 per cent permanent cures, the prognosis of mammary tuberculosis is designated by the author as favorable The assertion appears justifiable, that in comparison with tuberculous affections of other organs tuberculosis of the breast must be regarded as a relatively benign disease, when submitted to radical surgical treatment

A further report of five personal observations is made by Mantelli (Morgagni, March, 1910, Part I, p 98) Three of these were of the disseminated type and two of the confluent type The last two patients were treated by amputation of the breast with evacuation of the axilla The treatment of the first group consisted in resection of the affected areas The

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<sup>2</sup> If record case may well have been of this variety—C. A. P.

outcome in all cases was favorable. Two of the patients treated by resection had been well for two and three years, respectively, at the time of the report.

As regards the management of this condition Schley<sup>3</sup> (ANNALS OF SURGERY, April, 1903, St. Luke's Hospital, Med and Surg Reports, 1910) tabulates the following procedures:

(1) Curetting of sinuses, (2) cauterization of sinuses, (3) injection of sinuses and cavities, (4) incision or aspiration of abscesses, (5) removal of the tumor alone, (6) removal of the axillary glands alone, (7) removal of the tumor and a portion of the breast, (8) removal of the breast and tumor, (9) removal of the breast and axillary glands.

Of these the classical operation must be the thorough removal of the breast, pectoral fascia, and axillary contents. The axilla should invariably be evacuated, and it will be found that the glands therein are almost always tuberculous. Exceptionally, as in the fourth case of my own series, one may content himself with removal of the affected portion of the breast, the underlying pectoral fascia, and the axillary glands. In very exceptional instances, as in patients with advanced pulmonary tuberculosis, one may resort to some other of the procedures enumerated by Schley.

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<sup>3</sup> An admirable contribution containing a complete bibliography.

# ANGULATION OF THE JUNCTION OF THE HEPATIC AND COMMON DUCTS AFTER CHOLECYS- TOSTOMY, SIMULATING COMMON DUCT OBSTRUCTION.

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ON several occasions the writer has been rather puzzled by observing that, after a comparatively simple cholecystostomy for gall-stones, when it was apparently obvious that the bile-passages were completely cleared of calculi at the operation, either the biliary fistula persisted, or, if it closed, symptoms of biliary obstruction,—jaundice and colic,—developed. Under the impression that an incomplete operation had been performed and that one or more stones had been left in the common duct, a second operative attempt would show that the choledochus was entirely free of stones, that a sound could easily be passed into the duodenum after choledochotomy, and that after cholecystectomy, or even after freeing the gall-bladder from the abdominal wall, closing it and dropping it back into the abdominal cavity, the patient would make an uninterrupted recovery. To satisfy one's conscience, that euphemism "adhesions" would be advanced in explanation of these incongruities. In discussing the question with several of my colleagues, I learned that they have had similar experiences, and that they were at quite the same loss to explain the problem as I was.

Very recently I was able to make most accurate observations on such a case\*. I am convinced that these observations explain many of my previous experiences, and I also believe that they constitute a very potent argument against cholecys-

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\* Patient present at the Surgical Section of the New York Academy of Medicine November 1, 1912

tostomy and for cholecystectomy I also believe that the complication of cholecystostomy depicted in the following case is by no means uncommon and deserves serious consideration when this operative procedure is contemplated

E S, female, married, age 19 years, admitted to the surgical service of the German Hospital, July 20, 1912

Patient has one child, five months old

For two months she has had frequent attacks of cramp-like pain in the right hypochondrium The pains radiate to both sides and also to the right scapula With the severe attacks there has been nausea and vomiting There has been slight jaundice after the severe attacks She has lost considerable weight in the past three months Her appetite is poor and her bowels are constipated She has never noticed any stones in her stool

*Status præsens*—There is decided tenderness and some rigidity in the right hypochondriac region There is a slight subicteric hue to the conjunctiva There is no distinctly palpable tumor Temperature 100.2° F Pulse 84 Respiration 20 Urine contains bile, and the stools are light in color

*Diagnosis*—Subsiding cholecystitis Calculi in the gall-bladder

*Operation* (July 24, 1912) *by author*—Longitudinal incision through right rectus Gall-bladder large, slightly congested, but walls not thickened Gall-bladder aspirated at fundus, slightly viscid bile Gall-bladder opened and five medium-sized stones removed Ducts carefully palpated and found empty An attempt to bougie the choledochus through the gall-bladder was unsuccessful As the gall-bladder was not much diseased, a cholecystostomy was performed by inverting the opened fundus of the gall-bladder over a drainage tube by means of a Lembert purse-string suture The gall-bladder was then fixed to the parietal peritoneum by several sutures It is to be emphasized that the gall-bladder was neither shrunk nor retracted, and that its fixation to the abdominal wall was accomplished without the slightest tension A gauze drain was placed below the gall-bladder, and the abdominal wound, except for the drainage opening, was closed in layers

The patient reacted well after the operation, and there was a free drainage of bile through the tube



August 1, 1912—Tube and gauze drain removed Small gauze tampon inserted

There was a prompt stoppage of the biliary drainage There was a mucopurulent discharge from the wound

August 9 to 16, 1912—Frequent attacks of severe colicky pains Evident icterus Acholic stools

August 17, 1912—Reopening of gall-bladder wound at dressing, by forcible insertion of dressing forceps into sinus Profuse biliary discharge The discharge of bile continued, the stools

FIG 1

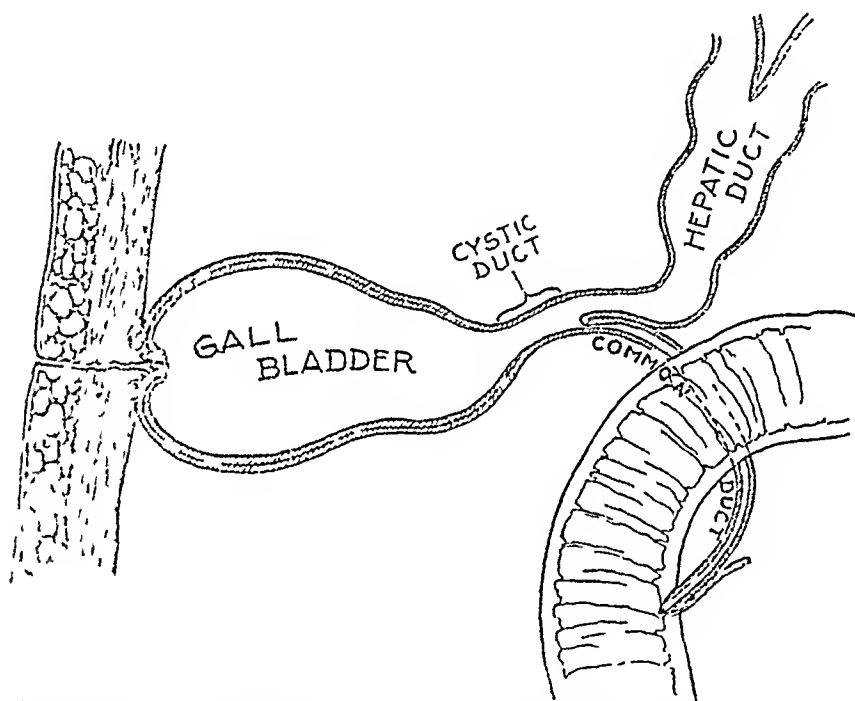


Diagram showing angulation of the junction of the hepatic and common ducts after cholecystostomy. Note dilatation of the hepatic duct and valve-like formation at junction of hepaticus and choledochus

were clay colored and it was apparent that there was an obstruction to the flow of bile into the intestine. It was assumed that the original operation had been an incomplete one and that there was now one or more stones in the common duct. Operation was decided upon and performed by the author on August 24, 1912.

*Second Operation*—Incision through old scar after curetting and tamponing sinus. The contracted gall-bladder was freed down to the cystic duct. No stones were felt in the gall-bladder or in any of the ducts. A kinking of the junction of the hepaticus and choledochus was found. The angle formed by the junction

of these two ducts was less than 45 degrees. After ligation of the cystic artery, the gall-bladder was removed. The stump of the cystic duct was then split upward into the hepatic and downward into the common duct. Though there was a valve-like formation (Fig. 1) at the junction of the two ducts, a large probe was easily inserted into the duodenum and also upward into the hepaticus, which was dilated. No sign of a calculus. A tube was inserted into the hepatic duct for drainage and sutured in place. One gauze wick was led to the opening in the ducts and another to the bed of the gall-bladder. Wound, except for drainage opening, closed in three layers.

The reaction after the operation was rather severe, but after 24 hours the patient began to make a prompt and uneventful recovery. The drainage through the tube was not good, but the dressings were constantly soaked with bile.

August 30, 1912—Drainage tube and gauze wicks removed.

The flow of bile began to decrease at once. The stools were well colored and the wound healed rapidly. There was no recurrence of the colicky pains.

September 9, 1912—The wound is almost closed. There is very slight biliary drainage. The stools are normal. There is no pain. The patient is out of bed.

September 10, 1912—The wound is closed and the patient is entirely cured of her gall-bladder condition.

September 28, 1912—Discharged cured.

An epicritical review of this case must lead us to the following conclusions. After a simple cholecystostomy done in the most approved fashion on a comparatively normal gall-bladder, which was not in the least retracted and which was fixed to the peritoneum of the abdominal wall without the slightest tension, a symptom-complex develops which most strongly suggests the presence of a stone in the common duct. On relaparotomy no stone is found, but it is seen that an angulation has developed at the junction of the hepaticus and choledochus. At the angulation a valve has formed so that the flow of bile into the intestine is almost impossible. Hence the pain and jaundice when the biliary fistula was closed and the tendency toward persistence of the fistula after it was reopened. Though there was no tension upon the duct, the

gall-bladder was fixed to the abdominal wall, there must have been a decided contraction of that organ after the first operation. This contraction, probably aided by the pull of the respiratory movements, resulted in the angulation. The condition was promptly cured by cholecystectomy, which permitted the angle at the junction of the ducts to straighten out.

A careful perusal of the literature of gall-bladder operations shows that this complication of cholecystostomy has been more or less overlooked. To be sure most of the text-books mention the persistence of a biliary fistula after cholecystostomy according to the old technic when the gall-bladder was fixed to the skin and "Lippen" fistulæ were common. Kehr on several occasions mentions in most general terms that occasionally very disagreeable distortions of the biliary tract may follow cholecystostomy, and even in his excellent review at the Second International Surgical Congress he is no more specific. Only in his text-book on gall-stones, published in 1905, does he really definitely suggest the possibility. In speaking of the causes of biliary fistula after cholecystostomy, he says "The fixation of the gall-bladder to the parietal peritoneum may produce too great a tension on that organ and on the choledochus, so that the flow of bile into the intestine is impeded. This was a common occurrence when the technic of gall-bladder surgery was in its infancy. If the gall-bladder is pulled too forcibly to the parietal peritoneum for the purposes of fixation, or if the fundus of that organ is sewed to the muscle or skin, one need not be surprised if a permanent biliary fistula is the result. With good technic these fistula can *always*\* be prevented. One must not put too great a tension on the gall-bladder, and small, contracted gall-bladders must not be sewed to the peritoneum at all. They should be drained by the tube method or, better, excised. One must avoid all tension, one should sew the gall-bladder as high up as possible in the abdominal wound, and one must always remember that a secondary shrinkage is possible. The less frequently one performs cholecystostomy the less frequently

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\*It is more

will one have to deal with biliary fistulæ Cholecystectomy is the best means to prevent a biliary fistula, and likewise the most radical method of curing an existing one" Kehr also publishes a diagram that in some respects resembles my illustration, which was made from a sketch of my own, drawn immediately after the operation

As will be seen, Kehr attributes this complication to improper technic in the performance of the cholecystostomy. I believe it is perfectly possible for it to be due to the operation, *per se*, with the observance of the most accepted technic Kehr believes that this distortion of the ducts can only occur if too much tension is put on the gall-bladder at the primary operation, as, for instance, by sewing, forcibly, a contracted or retracted gall-bladder into the abdominal wound I am convinced that it may occur by secondary shrinkage and respiratory pull when the anatomy and location of the gall-bladder are entirely satisfactory at first and when the gall-bladder is sewn to the peritoneum without the least tension primarily I agree absolutely with Kehr that a certain means of preventing this angulation of the hepaticus and choledochus junction is primary cholecystectomy

Of course, if one uses what Kehr terms the "tube method," dropping the gall-bladder back into the abdomen, the chances of kinking are greatly reduced Still the sinus itself may contract and the method, in my opinion, is not one of choice Leakage into the peritoneal cavity is, at least, theoretically possible, even if, practically, this danger is minimal

To avoid this angulation of the junction of the ducts ideal cholecystotomy might be performed in the type of case under consideration The advantages of this operation are very questionable, however The calculous gall-bladder is inflamed and requires drainage, if it is not removed, the danger of recurrence is greatly increased if the gall-bladder is left in and is not drained, stones that may have been overlooked can escape through the drainage opening if one exists, finally, the possibility of leakage of the gall-bladder suture must also be considered

# STRANGULATED INGUINAL HERNIA IN EARLY INFANCY.

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THE preparation of this paper was undertaken with a three-fold purpose (1) of placing on record a case of the writer's in keeping with the subject, (2) of assembling cases reported in the literature, and (3) an examination and discussion of the literature, limiting discussion to cases occurring in infants under six months of age

The youngest case on record, operated upon for this condition, appears to be that of Woodbury's,<sup>68</sup> operated by Andrews in August, 1874. The child was 45 hours old when the strangulated right inguinal hernia demanded operation. At the end of this time the hernia was the size of the child's head. Ether was used as an anæsthetic. The neck of the sac was relieved by knife and dilatation by the fingers. The tumor contained the greater part of the large intestine. Complete recovery followed operation.

White,<sup>64</sup> Stern and Burnier<sup>56</sup> report each a case operated at 11 days of age. Bull and Coley's report contains one case at 13 days.

McLaurin,<sup>11</sup> in 1900, reported a case of strangulated right inguinal hernia, operated by him in the Prince Alfred Hospital, Sydney. The child was 14 days old when operated, and the hernia had been strangulated for 36 hours. He did not stop to make exact differentiation of the parts in his case. Recovery followed operation.

Stiles<sup>57</sup> and Goinard<sup>27</sup> each reports one case operated at 14 days. Jopson reports a case operated at two weeks, in which the strangulation had been present 24 hours.<sup>31</sup> Carmichael<sup>12</sup> also reports one case operated at two weeks, Estor<sup>22</sup> one at 15 days, and Dun<sup>23</sup> one at 17 days.

The writer's case (operation at 18 days old) —On the evening of June 24, 1910, the writer was called to see a male child, weight  $4\frac{1}{2}$  pounds, emaciated and illy-nourished. Although breast-fed up to this time, the child's stools, according to the mother's statement, had been green and foul-smelling since birth (June 6, 1910). During the afternoon the mother had administered a glycerine enema. This was returned, accompanied by blood and mucus and a few bits of feces, and the babe vomited yellow fecal contents of the upper intestine. Examination revealed double inguinal herniæ—both being down at the time. The one on the right could be completely reduced by moderate manipulation, but the left one could be but partially reduced. Fearing injury to the gut from too vigorous and prolonged efforts at taxis, and in view of the fact that a dose of castor oil had been given, the mother was advised to keep the babe quiet as possible, the tumor under slight pressure, the head somewhat lower than the feet, and to call assistance if needed before morning. The tumor at this first visit was about the size of a large English walnut.

At five o'clock the next morning the babe was again seen. Stercoraceous vomiting had been repeated. There had been no further dejections, and the left hernial tumor was larger, hard, tense and blue with congestion, tympanites increased and the little infant visibly exhausted. No reduction of the tumor could be obtained. The right one was easily reduced.

The infant was now removed to the hospital, where, less than two hours later, the infant was given chloroform, and an attempt again made to reduce the tumor by taxis—the child's body being held head-downward—but the attempt was a failure. Accordingly the hernia was cut down upon. The tense, congested gut showed through the almost transparent peritoneal sac. The latter was opened and the gut examined for signs of gangrene. None presented. The inguinal ring was, by means of forceps and a nick at the upper edge, dilated sufficiently to draw out a few inches of the abdominal gut for inspection. Circulation in the congested portion was reestablished by hot compresses and the gut returned to the abdomen. Closure of the wound was a very uncertain consideration, owing to the frail structures. Muscles and fascia were stitched over and over as securely as possible with No. 1 chromic catgut and the skin with a running suture of the same. No attempt was made to transplant the cord. A thick pad of gauze

wrung out of boric and alcohol solution, was placed over the wound and supported by a napkin pinned tightly in place. The babe was returned to the nursery, placed in warm blankets and surrounded by hot-water bags. Respiration was imperceptible, and no pulse could be felt. A drop of brandy on the tongue, artificial respiration, and strychnine sulphate gr 1/300 hypodermically were administered, and in ten or fifteen minutes the babe was breathing independently and crying soon afterwards. At 11 30 A M (about 4 hours after operation) a profuse, foul-smelling dejection occurred voluntarily, containing a few streaks of blood. This was the last blood seen. The stools gradually regained a normal color and odor. Artificial feeding was begun at once, and the babe gained 1¼ pounds during its stay of two weeks in the hospital. The wound was kept clean by fresh dressings of gauze wrung out of boric and alcohol solution at each change of napkin. Healing was by first intention.

Two or three times during the first 48 hours and once on the third day a small bulging presented beneath the lower end of the wound during crying spells. This was reduced and held in place by counter-pressure, and thereafter no recurrence of hernia occurred. The babe was continued on a modified formula of malt soup and cow's milk and gained steadily, weighing, at 3 months of age, 8½ pounds—a gain of 4 pounds.

In this case the babe was first seen on the evening of the 17th day of life and operated on the morning of the 18th day. When the child left the hospital the mother was cautioned to carefully watch for any recurrence of the hernia on the unoperated side, and also cautioned against allowing the child to become constipated. The operation was done primarily to save life and not primarily for radical cure of the existing herniæ.

Kirmisson<sup>25</sup> reports a case operated at 18 days with recovery.

Another case on the 18th day is reported operated upon by J. L. Sageron,<sup>70</sup> Johnstown, Pa. The case is recently quoted by Murphy. Fecal vomiting and an empty lower bowel were present. The child was removed to the hospital and the first incision made without anæsthesia. After release of the constriction, the child's condition seemed to be easier and

chloroform was administered. The appendix was found within the hernial sac and removed. The child was allowed to nurse on the second day. Good recovery followed operation.

Bidwell<sup>4</sup> cites a case in which he operated at 19 days.

From the 27th day to one month several cases are reported by English, French, and American writers, notably Bilhaut,<sup>5</sup> Thomson,<sup>61</sup> Whitacre,<sup>63</sup> Reed,<sup>51</sup> Stretton,<sup>58</sup> and others.

From one to six months the recorded cases are relatively less numerous. Telford<sup>59</sup> collected 112 operated cases up to six months of age and tabulates them as follows:

Age in months	1	2	3	4	5	6
Number of operations	34	27	24	12	6	9—112

Kirmisson<sup>38</sup> quotes Mayer, who collected 105 cases, 72 of which occurred under six months of age and 33 between six months and one year. He quotes Pettijohn also (Paris, 1899), who collected 59 cases six months or under, and 22 cases six months to one year.

The table below is given for the purpose of illustrating the manner in which the cases decrease in number up to six months of age.

	1 mo	2 mos	3 mos	4 mos	5 mos	6 mos	Totals
Mayer	18	17	16	9	5	7	72 cases
Pettijohn	15	17	9	5	5	8	59 cases

*Etiology and Occurrence*—Judging from the large number of herniæ found in adults, and from those we are accustomed to regard as congenital, it seems very reasonable to state that strangulated inguinal hernia, at a very early age, while not an exceptionally rare occurrence, is still comparatively so, though in the last few years case reports are becoming more numerous. Undoubtedly the cases we never hear of are those in which the symptoms of strangulation are attributed to colic by the mother or nurse.<sup>62</sup>

In reviewing the histories of 15,000 cases of inguinal hernia in adults, Coley found that about one-third of them had had hernia in infancy or childhood.<sup>85</sup> Carmody says not  $\frac{1}{2}$  of 1 per cent of the cases of hernia occurring in infants become strangulated.

Estor,<sup>23</sup> writing in 1903, says that strangulated inguinal hernia is rare



the usual compilation of dull historical data, for aside from the fact that the cases themselves are out of the ordinary, they are described in so interesting a fashion that the reader frequently feels he is actually becoming acquainted with this or that particular patient, just as one learns to know a character from a novel or a biographical sketch. The summary of the hypophyseal symptoms and the epicritical analysis in each case deserve special commendation. The histories are further enlivened by excellently chosen photographs, and by radiographs of the sella and extremities, which are reproduced in their natural size. Perimeter charts, photographs of pathological specimens, and microphotographs of the pathological findings are added wherever possible.

Part III is devoted to an analytical review of the incidence, the symptomatology, and the treatment of hypophyseal disease based mainly upon the author's personal experience. It would be impossible in the space allotted to me to give a satisfactory abstract of this portion of the book. Every sentence is significant, and I shall only indicate the general trend of the argument. Each particular symptom, neighborhood, general pressure, glandular, and polyglandular, is carefully analyzed and its relative importance dwelt upon. Three new cases are added to illustrate hypophyseal glycosuria and hypophyseal epilepsy. Perhaps a trifle too much stress is laid upon the significance of glycosuria in hyperactivity and increased carbohydrate tolerance in insufficiency of the posterior lobe.

The lesion itself, certified in twenty-nine cases, is next discussed, and finally the question of treatment is taken up in detail. The indications for surgical intervention, namely, to relieve the general pressure symptoms, to combat the functional hyperplasia, and to relieve the neighborhood symptoms, are considered *seriatim*, and the various methods of approach are reviewed.

For direct sellar approach Cushing has finally adopted a one-stage transphenoidal operation with sublabial incision and submucous septal resection. This is practically a combination of Kanavel's inferior nasal and Hirsch's endonasal operation. Every effort should be made to avoid lacerating the mucous membrane, and the turbinates are flattened out by retraction and dilatation, but not removed. The use of urotropin as a preventative against meningitis, and the importance of careful radio-

The symptomatology in children differs from that in the adult chiefly upon the absence of subjective evidence and the tendency to more rapid collapse. The objective symptoms are nausea, vomiting, constipation, or obstipation, tenesmus, local tenderness, swelling, hernial tension, blood and mucus per rectum, variations in pulse from the quick hard variety, followed later by the wiry, small, weak, and more rapid variety. The face, depending upon the patient's general condition, may be flushed with fever or pallid, as in shock, pinched and drawn.<sup>65</sup> The cardinal symptoms more peculiar to infants are violent and uncontrollable screaming, recurrent vomiting (often fecal in character), tendency to retention of the urine and constipation, facies suggesting shock, also a great tendency to rapid collapse.<sup>31</sup>

*Contents of the Sac* — These are most frequently the small intestine or portions thereof, though not infrequently the cæcum and appendix are found. Estor observes that the appendicular and cæco-appendicular varieties are more frequent than in adults.<sup>26</sup> Stiles found the cæcum in the hernial sac in 7 per cent of his cases. The cæcum is more mobile in children than in adults.<sup>57</sup> He regards such cases as more liable to become irreducible, incarcerated, or strangulated. In Telford's 104 cases the small intestine was found in the sac in 83 cases, the cæcum and appendix in 21 cases.<sup>59</sup> In Estor's 225 cases the appendix or cæcum and appendix appeared in the sac in 17.<sup>25</sup> The omentum in infants is ordinarily not developed sufficiently to be found in the sac.

*Diagnosis* — The diagnosis presents few difficulties, and these chiefly in comparison with the diagnosis in adults. An accurate history is of the utmost importance. In the presence of vomiting, especially if of stercoraceous material, in the absence of stools, the presence of pallor, sunken eyes, the possible retention of the urine, and, very rarely, the symptoms of early peritonitis, one should be fairly sure of the diagnosis. Herr makes a special point in emphasizing vomiting, pinched or drawn countenance, and the absence of stool, in establishing a diagnosis. An inflamed ectopic testicle should also be con-

sidered The possibility of an acute hydrocele must be considered as well, and an effort made to rule this out in making a diagnosis

In the Stern and Burnier case a diagnosis of strangulated inguinal hernia was first made on the 10th day of the infant's life Upon further examination the diagnosis was changed to hydrocele The symptoms soon took on a serious aspect, however, and the operation was done 30 hours after the appearance of the tumor Operation revealed a gangrenous gut with two perforations, due to strangulation Artificial anus was made and the infant recovered This case serves to illustrate the rapidity with which the infant intestine may go on to gangrene, the possible non-appearance of alarming symptoms until gangrene and perforation may be present, and also the unusual recuperative power of an infant having sustained a serious operation Gangrene may take place in one hour, or it may not take place for 24 hours or more <sup>64</sup> It should be borne in mind that hernia in a young infant may be quite translucent <sup>15</sup> Clogg cites two cases, in one of which the hydrocele was tapped and a complicating hernia discovered

*Prognosis*—In general, authorities are agreed that the prognosis in these cases is good in proportion as the diagnosis is established early and the case operated upon promptly Dun makes the statement that the older the child the shorter duration of strangulation, and the less prolonged efforts at reduction by taxis the better the prognosis <sup>23</sup> Bidwell is inclined never to give a bad prognosis, owing to the fallacy of the belief, in past times, that it was not possible to operate without a large percentage of infected cases <sup>4</sup> While infants show a great tendency to collapse during the state of strangulation, it is noticeable that, with the relief of the strangulation, they recover very rapidly and quite satisfactorily <sup>4</sup> Reid (J A) believes the prognosis depends upon the duration of strangulation and the amount of damage done by taxis previous to operation

As to operation at a very early age, Stiles, in speaking of cases not strangulated, observes that if he were asked at what

age to operate he would say "just before teething" Of his operations for radical cure 26 per cent were under 12 months old Lucas also advocates early operation for radical cure, and discourages the use of the truss <sup>40</sup>

*Mortality*—Unfortunately, all the cases reported in the literature are not supplemented by a statement concerning the recovery or death of the patient The opinions of various writers tend to establish the fact, however, that the mortality should be much less in infants with strangulation, if properly cared for, than in adults Most of the mortality is due to waiting Taking the cases as they run, the tables, according to Estor, show an aggregate mortality of 23 per cent Authorities are agreed that this should be very much less Coley considers that the mortality should be considerably smaller than that in adults In his 17 cases operated there were no deaths Dowd believes that the mortality should be not to exceed 10 per cent when operation occurs promptly <sup>22</sup> Reid (W B) believes that were these strangulated cases in infancy operated under aseptic conditions and early, before they had been maltreated by taxis, the mortality need not be more than 3 per cent Reid (J A) believes that the mortality should be less than 1 per cent

*Treatment*—Mistakes are made, either in prolonging efforts at taxis or in instituting too vigorous taxis Rough handling of the hernial tumor is a dangerous procedure <sup>31</sup> The child is not able to tell you how much pain you are causing, as the adult is Moreover, taxis, if one has a case of strangulation, is seldom rewarded by reduction of the hernial tumor This places upon the operator the responsibility, therefore, of being prepared to operate at the same time he makes his preparations leading to the anæsthetization of the child for the purpose of reduction. It is almost axiomatic that, with the failure of reduction by taxis, operation is imperative It is not taking too broad a step to assert that the operation should be as nearly immediate as is possible There is no other method of dealing with the condition other than operation, which gives promise of results which are nearly as good <sup>22</sup> In the absence of reduc-

tion by taxis, with prolongation of strangulation and its attendant symptoms, the child will most assuredly die if not relieved by operative interference. The ultimate result of strangulation is gangrene.

*Operative Methods*—Having established a diagnosis and being prepared to operate, the question of anæsthetic presents itself. The greater percentage of the cases reported have been given chloroform. This may be in accord with custom at the various times in which the reported cases were dealt with, or it may be due to a more or less prevalent belief that infants and children should have chloroform rather than ether. Herr, in his case, used ether-chloroform. One operator made his original incision without any anæsthetic, and later in the operation gave chloroform. The writer has found no cases reported in which a local anæsthetic was used. In one case reported by Guion no anæsthetic was used throughout the operation. In the present day, with the almost universal use of ether, it is probable that this will be the anæsthetic of choice. Children take it well, and it requires very little more time than chloroform to administer. Dowd believes it is much better than chloroform for this class of cases.

In discussing the administration of anæsthetics to children at the New Jersey State Medical Society, 1912, Tuers said "There are practically but two anæsthetics to be considered—chloroform and ether. We should administer the least dangerous drug in the least dangerous way. Chloroform is the pleasanter of the two, but the more dangerous."

The choice of operation is not a momentous question. A simple, time-saving operation is essential. It would be folly to attempt a too extended operation, consuming much time, when dealing with an exhausted infant requiring operation for strangulation. At the Mayo clinic they have found it unnecessary to transplant the cord in young children. Coley and others follow this procedure. Cumston, after reviewing the various methods of operation for inguinal hernia in children, and considering those of Kocher, Broca, Macewen, La Dentu,

Magnai, Ball, Barker, Lucas-Championniere, Kimmisson, Russell, Fiolich, Folizet, Gaudier, Cooper, and others, believes that the Bassini is the best for a rapid, simple, and at the same time thorough operation. Dowd also favors the Bassini. Many of the operators who have reported cases demanding surgical relief for strangulation have followed no definite operative method. It is to be borne in mind when one operates in these cases, that the procedure is attempted primarily to save life, and not primarily to effect a radical cure. Occasionally complications present, making it advisable, even necessary, to do more than merely relieve the constriction.<sup>56</sup>

Whitacre<sup>63</sup> discovered in a child of 7 weeks a strangulation which had been present 4 days. Upon making his incision, the gut was found to be not only gangrenous but wide open, freely discharging its contents. He resected 5 inches of the gut, and did a lateral anastomosis at the first operation, in addition to relieving the constriction. On the day after the operation he reopened the abdomen on account of persistent fecal vomiting and increasing tympanites. At this operation he placed an enterostomy tube just above the anastomosis. From this on the child improved, taking the breast 10 hours later. On the 6th day after the first operation he did a third operation, making an end-to-side (ileum into cæcum) anastomosis. The operations were apparently well endured, and the child made a good recovery. This serves as another brilliant illustration of infantile recuperative power.

The appendix, in several instances where present in the sac, has been removed during the operation for strangulation and with no ill results.

We are at liberty, therefore, to conclude, from the past experience of numerous able operators, that the operation looking toward the relief of strangulation in infants is not to be regarded as a very forbidding one. It should not consume a great amount of time, and if done promptly and with proper aseptic technique one should feel confident of a favorable outcome. Operation has undoubtedly been delayed, in the past, on account of the tender age of the patient, as well as of the fear of sepsis following. That this latter fear is largely unfounded is illustrated by Campbell's 305 cases in infants and children, 77 per cent of them being under 3 years old and

34 per cent under 6 months<sup>11</sup> In his series of cases there were only two which suppurred

Moreover, too many cases have been subjected to prolonged delay and treated to an excess of taxis Such prolongation should be regarded as pernicious No physician is justified in delaying operation until the prognosis is bad, and no operator need fear to handle these cases in the ordinary surgical way The greatest mortality is due to procrastination, or unintentional or, perhaps, unavoidable delay before operation

The treatment of the sac is somewhat important, inasmuch as the vas is very delicate in infants, usually lies close to the sac, and is very easily injured by manipulation The risk of removing the sac, therefore, is emphasized by Lucas, and several operators feel that the sac is better left alone and neither tied, cut, nor removed

The urgency of treatment is greater in these younger infants than in like cases occurring in adults, owing to the rapid necrotic changes which so commonly follow any interference with the circulation in the delicate bowel, the urgency is also greater, owing to the early appearance of shock.

The manner of suture, closure, and dressings has varied in the past and may be summed up in a few words use the simplest method consistent with the severity of existing conditions An attempt to transplant the cord is usually unnecessary Simple suture of the soft parts and closure of the wound without drainage, and either the method of Stiles for superficial dressing, or sealing the wound with collodion, may be found preferable Stiles recommended at first an emulsion of glycerine and iodoform, later he used dry boric powder He bandaged the legs and arms and fixed the child so that the dressing could not be disturbed and left fairly free access of air to the wound The urine in boys was collected by means of a glass tube left in place Occasionally retention of the urine will be met with for the first day following operation<sup>61</sup>

Some operators dislike the collodion dressing It has its disadvantages. The writer's experience with the boric and

alcohol dressing, applied at every change of napkin, proved very satisfactory, and it is a reasonably simple procedure. Intelligence on the part of the nurse is essential to its successful use, one must add. There was no maceration of the skin, the chromic subcutaneous skin suture held the wound in close apposition, and there was absolutely no sign of infection at any time.

Some very successful cases have been reported where operation became imperative under most adverse circumstances—in the home, on a kitchen-table, no surgical assistance whatever and no reliable after-care<sup>58, 44</sup>

The following table is presented of cases reported since 1907, and not included in Ashhurst's table of 15 cases

Operator	Sex	Age	Duration of strangulation	Contents of sac	Condition of bowel	Result
Adams	M	2½ mos	12-18 hours	?	Good Replaced	Recovery
Clogg	?	5 wks	?	?	?	Recovery
Collins	M	18 days	12 hours	Small intestine	Good Replaced	Recovery
Cordier	M	2 mos	?	?	Good Replaced	Recovery
Grossmann.	?	4 wks	?	Cæcum and appendix	Gangrenous	Recovery
Hopkins	M	4 mos	30 hours	Intestine and omentum	Fairly good (adherent) Replaced	Recovery
Jopson	?	2 wks.	24 hours	?	Good Replaced	Recovery
Judd	M	22 days	24 hours	Small intestine	Good Replaced	Recovery
Ruotte	M	3 mos	?	?	Good Replaced	Recovery
Ruotte	M	6 mos	?	?	Good Replaced	Recovery
Sageron	M	18 days	24 hours	Cæcum and appendix	Fairly good Replaced App removed	Recovery
Stern and Burnier	M	11 days	30 hours	Unrecognizable	Gangrenous Artificial anus	Recovery
Starr, V H	M	5 mos.	About 5 hrs	Small intestine	Good Replaced	Recovery



## SUMMARY

In proportion to the large number of herniæ existing in infants and children, the strangulated cases are comparatively rare, though case reports are becoming more numerous. It would seem that the older the infant the less subject to strangulation is he. In other words, hernia strangulation under one year is more common than later. Statistics show the greatest frequency in the first three months of life. The relative frequency of strangulation in children to that in adults is variously estimated as 1/62, 1/107 and 1/108. There seems to be a tendency to underestimate rather than to overestimate the number of cases calling for operation.

Writers are not agreed as to the specific cause of strangulation.

Few cases are reported wherein is demonstrated incarceration. The relatively short duration of strangulation probably accounts for this.

The cardinal symptoms peculiar to infants are violent and uncontrollable screaming, recurrent vomiting (often fecal), drawn facies, tendency to both retention of urine and rapid collapse.

The small intestine is most frequently found in the hernial sac. The cæcum and appendix have been found in the sac in from 7 to 20 per cent of cases. The omentum is rarely found in the sac.

In the diagnosis one must be on the lookout for the possibility of acute hydrocele, also acute inflamed ectopic testicle.

Authorities are agreed that the prognosis in these cases is good in proportion as the diagnosis is established early and the case operated promptly. Some of the worst cases of gangrene and perforation have recovered under proper surgical treatment. Fear of infection should not be considered a serious objection to operating, when done under proper conditions.

While infants show a tendency toward collapse when the hernia is in a state of strangulation, this resolves itself when

the strangulation is relieved, and they recover rapidly and quite satisfactorily

The consensus of opinion is that the mortality should be much less than in similar cases with adults. Most of the fatalities are due to waiting. Dowd believes the mortality should be 10 per cent. or less when the operation occurs promptly. Others would cut this down still further—to 3 per cent. or even less than 1 per cent.

Taxis is dangerous, and rough handling courts disaster. Taxis is seldom rewarded by reduction of the hernial tumor where strangulation exists. With the failure of reduction by taxis, operation is imperative, or the child will most assuredly die, for gangrene is the ultimate result of unrelieved strangulation.

In the majority of reported cases chloroform was the anæsthetic. Ether will probably be found preferable, in the light of the present-day attitude.

The Bassini operation in infants and children is favored by Cumston and others. For strangulation the simplest operation is the best, bearing in mind that the operation is done primarily to save life and not primarily to effect a radical cure. The occasional case will be the exception. The operation, from this view-point, should not be regarded as a forbidding one. From the number of successful cases reported, the tender age of the patient is no contra-indication. On the other hand, procrastination and continued insult by taxis are unjustifiable and tend to increase mortality.

The urgency of treatment is greater in infants than in like cases occurring in adults, owing to the rapidity of necrotic changes following embarrassed circulation, also greater, owing to the early appearance of shock.

Care should be rigorously exercised lest in treatment of the sac the delicate vas be injured by manipulation. The risk of removing the sac is therefore emphasized.

The manner of suture, closure, dressings, and other after-care will depend upon the operator and his preferences. The experience of the past yields no didactic rule.

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# HERNIA ADIPOSA

FAT HERNIA, FETTBRUCH, HERNIE GRAISSEUSE

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INFREQUENTLY found in hernia regions, a condition termed fat hernia has been described as early as 1700 by Littre, case reports followed by Pelletain (1780), Cloquet (1819), Rosen (1850), English (1886), and Douglass (1889). Interesting and extensive theses by Wernher, 1869 (*Arch f path Anat Bul*, xivii, 472), also by Jonathan Hutchinson (*Trans of the Pathological Soc of London*, vol xxxvii), have been written, while during the past 20 years, either because it is not of sufficient surgical interest or because of its infrequency, practically nothing has appeared in medical literature about it.

## ILLUSTRATIVE CASES

CASE I.—*Incarcerated fat hernia, simulating irreducible inflamed omental hernia*

*History* (Referred by Dr M Kleinman) —Wm R, male, age fifty-three, for 15 years has had a reducible mass in the left inguinal region, always had worn a truss. Three months previous to my seeing him mass became irreducible, not painful up to about a week ago.

Examination showed a moderately tender mass about the size of a large orange in left inguinal region, extending well down into the scrotum, evidently coming out through the external ring. It was not fluctuating and not reducible, skin not adherent, dull on percussion, impulse on coughing, painful on pressure. Pulse normal, temperature 100°. Bowels regular. No vomiting. Diagnosis, irreducible inflamed omental hernia.

*Operation* (July 9, 1910) —Started with local anæsthesia and was able to proceed with this method up to and including the splitting of external oblique fascia. Dense adhesion of mass to surrounding tissues necessitated administration of a general anæsthetic, which was ether.

Upon splitting the external oblique fascia, a fusiform mass

of lobulated fat presented itself, extending from well below the external ring up to the internal ring, covered by thin fascial membrane at its lower part (intercolumnar fascia), also with a few spreading fibres of the cremasteric muscle. No sac was present. Densely adherent to surrounding structures particularly at external ring, as well as to the cord which was under the fatty mass. The external oblique fascia as well as the internal oblique muscle and transversalis were thin and well stretched. The mass occupied the entire length of the inguinal canal, tapering toward the internal ring, and originated in the preperitoneal fat at the site of the internal ring. After shelling it out the usual Ferguson operation was done.

On the second day patient began to pass bloody urine, very scant, and died of total suppression on the fifth day.

CASE II—*Lipoma of inguinal canal with true hernial sac present*

F. R., age twenty-five, referred by Dr. N. M. Mandl. Has had a double indirect hernia for past six or seven years. Always wore truss. Right side. Indirect scrotal hernia, left side, large ring present, but no hernial protrusion at time of examination.

*Operation* (October 11, 1909)—Right side. large sac containing omentum and adhering to sac. Resected. Usual Ferguson operation. Left side. sac present but closed at site where natural depression in the peritoneum at the internal ring was. To the fundus of this sac a pyriform shaped piece of fat, filling inguinal canal, size of a hen's egg was attached, undoubtedly causing a weakened canal, and large external ring. Both resected and operation completed as on right side.

Originating in the preperitoneal fat, it is not uncommon to find small elongated or pyriform shaped pieces of fat occupying the inguinal or femoral canals.

Unless it grows to an unusual size this condition does not give rise to any symptoms, and usually is not recognized before operation for hernia. When, however, hypertrophy of the fatty mass or lipoma occurs and during its growth becomes large enough to become appreciable, or appears at the external ring, or passes through the femoral canal and assumes or simulates the characteristics and symptoms of hernia, it is known as fat hernia.

Three distinct conditions may be present (a) fat hernia

without true hernia sac, (b) fat hernia with sac accompanying it, (c) lipoma of canal not giving rise to symptoms

As an independent condition, that is without a true hernial sac accompanying it, fat hernia is comparatively uncommon. There are more often present both fatty mass (extraperitoneal) and hernial sac, with or without contents. But this is not true fat hernia and should not be termed as such.

A pure fat hernia is extraperitoneal in origin and is not accompanied by peritoneal sac.

"In the sense of a true fatty tumor that forms in the subperitoneal fat, and from its own size and weight forces itself down through the inguinal canals, it is not believed that lipoma is very common" (De Garmo<sup>11</sup>)

Fat hernia may be found in the inguinal or femoral canals, at the linea alba, between the umbilicus and ensiform cartilage, very rarely below the umbilicus, at the latter situation the lipoma protrusion, also with or without peritoneal sac accompanying it. In the female it is more often present in the femoral than the inguinal region, while the reverse is the case in the male.

J. Hutchinson<sup>12</sup> found them more often to be present on the left than on the right side. Some observers believe these fat masses to be a strong etiological factor in the causation of hernia whenever they are present in either the inguinal or crural canals, and it is only reasonable to suppose that whenever these lipomata originate in the preperitoneal fat as they almost always do, in their gradual growth they are bound to sooner or later stretch and thereby weaken the muscular and fascial investment of the canal, so predisposing to hernia. So that when either due to its size and weight or plus intra-abdominal pressure it descends through the canal, it may drag a process of peritoneum with it, so causing a true hernial sac.

"It has been recognized that a sac of peritoneum may be drawn out from the cavity of the abdomen and not extruded from it.

"This condition has been observed by many anatomists and surgeons, and its general features are doubtless familiar

to all The process begins in a localized increase of sub-peritoneal fat, usually observed in relation to the abdominal openings of the inguinal and crural canals, seeing that at these parts a depression naturally exists, into which the fat may develop The interest of the process as occurring in relation to the deep abdominal ring is very great The walls of the inguinal canal lie in close apposition, a relation which intra-abdominal pressure tends to maintain. If, however, a mass of fat is formed in the subperitoneal tissue of the external inguinal fossa, as it increases it will insinuate itself in front of the defined inner pillar of the deep abdominal ring, and separate it from the anterior wall of the inguinal canal The process thus begun goes on until the canal is wholly occupied by the fatty protrusion, which ultimately projects at the superficial ring I have observed the fat in the tissue of the cord, and also in other instances quite separate therefrom and lying about it As the protrusion of fat increases in size and weight, it renders the canal still more patent, and by its weight and also by adhesions formed with the superficial tissues the peritoneum is drawn down after it" <sup>13</sup>

In the region of the linea alba, either because of diastasis of the fascia or due to some unusual strain, these fat masses slip through the fascial opening, so giving rise to true fat hernia

Another writer believes that the formation of the pad of fat in the canal is the cause of spontaneous healing of hernia

De Garmo is probably right when he states that "If there is nothing but fat in the canal, the wearing of a truss for a year may destroy it, and it is in such cases that occasionally we have records of remarkable cures of hernia in the adult by truss wearing" <sup>11</sup>

These fat masses vary in size and shape, usually originate from the preperitoneal fat, are lobulated, and held together by a fine network of thin membrane, which sometimes has the appearance of peritoneal sac or covering and may be mistaken for the true sac if this be present

In its gradual growth it attaches itself to the cord and walls of the canal, may be attached to the fundus of the sac, to the cord alone, or it may envelop entirely the hernial sac

"The capsule in some cases very closely resembles peri-



toneum, the chief difference being that it usually gives off many septa which lie between the contained lobules of fat. Sometimes, however, the capsule is so thin that it can hardly be detached.

"The contained fat differs only from omentum in that it is usually in large lobules unconnected together by a distinct membrane" (Jonathan Hutchinson<sup>12</sup>)

Through exploration of the fat mass when present is of practical importance and value in operations for hernia, because a small hernia sac may be covered over by it and overlooked.

The fat mass in the inguinal canal may be that of pre-vesical fat, the bladder or hernia of this viscus is to be thought of therefore so as not to cause injury to this organ.

Like a hernia, these lipomata in herniating through the external ring or septum crurale or linea alba may become either strangulated or irreducible.

The presence of a small fat mass in the canal is unimportant so long as it remains so, and its presence is practically impossible to diagnose until it gives rise to symptoms by either having passed through the external ring, through a split in the fascia as sometimes happens, or whenever it becomes strangulated. Pain, then, is a natural consequence and is present when circulation is interfered with.

When they grow to large size and assume the characteristics of a hernia the diagnosis is also difficult, especially so its differentiation from omental hernia.

In reducible fat hernias the characteristic "doughy feel" which a lipoma gives and that it is not *entirely* reducible, that is not within and into the abdominal cavity as an ordinary hernia would be, may give us a clue as to the true nature of the condition present.

There is no way whereby we can differentiate an irreducible fat hernia from that of irreducible omental hernia. Impulse on coughing may or may not be present in either case.

De Garino<sup>11</sup> says "It will be found, however, that when a swelling of this character is reduced to the canal it can still be felt under its fascial coverings. It does not drop back suddenly as would a piece of true omentum."

The differentiation of fat hernia occurring at the linea alba from that of ventral omental hernia meets with the same difficulties

When hernia is complicated with lipoma, thorough removal of all fat masses is necessary, as their presence tends to prevent proper closure of the canal by sutures. When these grow to large size and are recognized as such, they should be removed because they undoubtedly tend to weaken the canal and so predispose to the formation of true hernia

SUMMARY—I Comparatively uncommon as an independent condition, that is without true hernia sac accompanying it

2 It originates in the and is a hypertrophy of the pre-peritoneal fat

3 When present, it may cause true hernia by drawing down a process of peritoneum in its growth and descent

4 It is difficult to differentiate it from omental hernia when irreducible

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# FORMATION OF AN ARTIFICIAL VAGINA BY INTESTINAL TRANSPLANTATION.\*

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ABSENCE of the vagina may be congenital or acquired, if one can define a loss as an acquisition. In the former the internal organs of generation generally share in the aplasia, but not infrequently the ovaries are present and functionally active. In obliteration of the vagina consequent upon cicatricial contraction the result of traumatism, operations, cauterization, or the severer forms of vaginitis, the uterine cavity and the ovaries likewise may have been destroyed or the uterus and the ovaries may have been removed, but in many instances they remain unaffected physically and physiologically. The functions of the vagina are to drain the menstrual fluid, to serve as an organ of copulation, and to act as a birth canal. If the vagina is absent and the internal organs of generation are healthy, there is no question as to the necessity for the creation or the restoration of the vagina, first and above all to permit the retained menstrual fluid to escape, and second, if the patient is married or contemplates marriage, to allow sexual intercourse. It is doubtful whether any artificial vagina would serve as a birth canal. Of course, one could, instead of building a vagina, suppress the menstrual function by removing the uterus or the ovaries or both the uterus and the ovaries, but all would agree that these organs should be preserved unless their condition demands their removal. If the internal organs of generation are absent or functionally inert, should a vagina be formed merely for the purpose of sexual intercourse? This is the question with which we were confronted in the case herewith reported.

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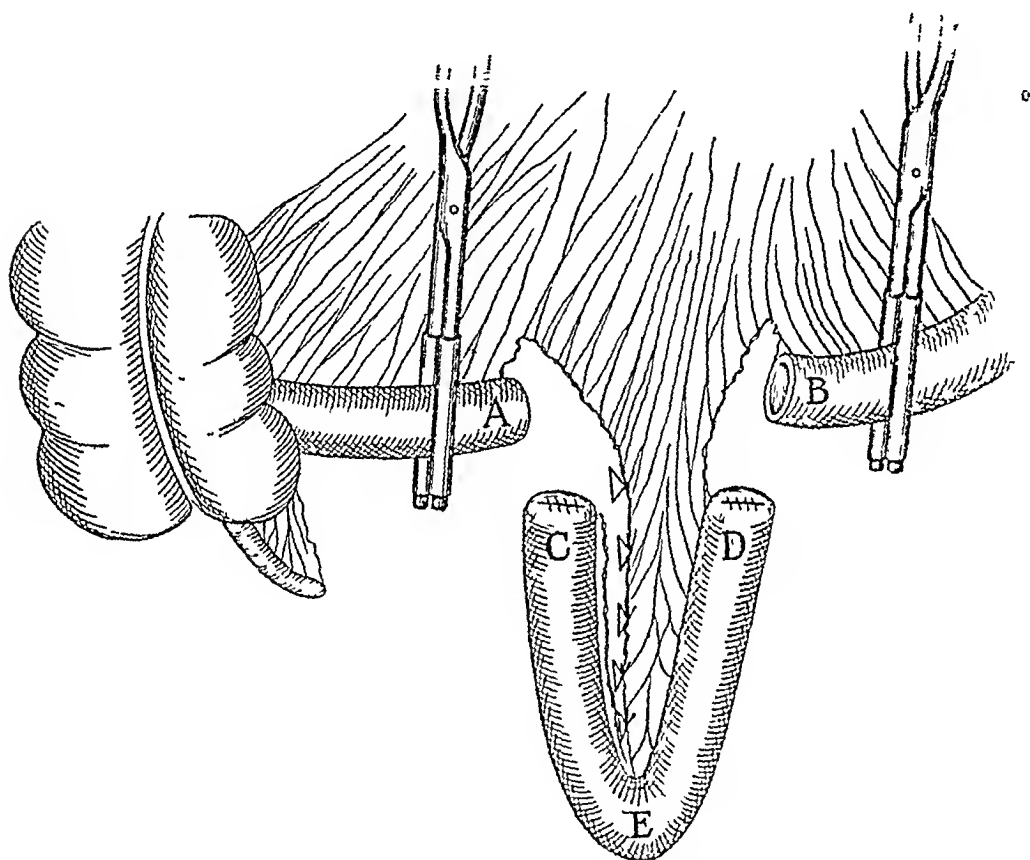
The patient, a woman aged forty-three, entered the Pennsylvania Hospital August 30, 1911. Seven years before admission a panhysterectomy had been performed in a neighboring hospital for carcinoma of the uterus. The bladder was accidentally torn or cut during this operation, and several attempts were made subsequently to close the resulting vesicovaginal fistula, all, however, without success. Upon examination the vagina was found to measure about two inches in depth and two inches in width. At its upper end was an opening, the size of a quarter of a dollar, leading into the bladder, which was markedly contracted and somewhat inflamed. After several superficial ulcerations which were present in the vagina had been induced to heal, we attempted to close the fistula in the following manner. The entire vaginal mucous membrane was excised, except over an area on the posterior wall corresponding in size to the opening in the bladder. The posterior vaginal wall was then separated from the rectum, and sutured to the anterior vaginal wall with catgut sutures, the undenuded area being fitted to the opening in the bladder. The perineum had been split to facilitate these manoeuvres, and the split, together with the space existing between the rectum and the new floor of the bladder, was now closed with buried catgut sutures, and a few sutures of silkworm-gut emerging on the skin of the perineum, thus obliterating the vagina. In separating the posterior vaginal wall from the rectum, scissors had to be used freely because of the large amount of scar tissue resulting from a previous perineorrhaphy, and during one of the snips the rectum was unexpectedly wounded. The small opening in the rectum was immediately sutured and gave no further trouble. The bladder was drained for 10 days by means of a retention catheter passing through the urethra. At the end of two weeks, there having been no leakage in the meantime, an assistant, without orders, irrigated the bladder because of the turbidity of the urine. Following this a small urinary fistula, finding exit on the perineum, was discovered. During the day the patient passed most of the urine through the urethra, but at night there was a constant dribble. The patient left the hospital, and returned at the end of three months asking that the vagina be reopened. She was content to endure the leakage of urine, but

stated that she must have a vagina or her husband would desert her. At first we demurred, but her pleadings were so earnest that we consented on the condition that the other members of the Surgical Staff agree with her as to the necessity for the building of a new vagina. Drs Harte, Hutchinson, Gibbon, and LeConte, of the Hospital Staff, and Dr Binney, of Kansas City, who was visiting the hospital at that time, examined the patient, and all unhesitatingly took sides with her, one of the gentlemen stating that any operation destined to preserve the marital relations and keep the home intact was not only justifiable but mandatory. We selected intestinal transplantation as the method most likely to give an enduring success. The nature and the possible dangers of the operation were explained to the patient, but she was not to be frightened. Loss of life meant less to her than the loss of her husband.

Accordingly the operation was performed, November 16, 1911, before the Congress of Surgeons of North America, which met at that time in Philadelphia. The patient was placed in the lithotomy position, an incision made between the labia, and a space created between the bladder and the rectum by blunt dissection, which space was cautiously deepened until the peritoneum had been opened. A temporary tampon was then inserted, the patient placed in a horizontal position, and the abdomen opened by a longitudinal incision above the pubes. Our idea was to use, instead of the small intestine, the sigmoid flexure, because of its larger size and the absence of digestive juices, but finding its mesentery too short we were forced to select a segment of the ileum. A coil not far from the cæcum was drawn from the abdomen and found to reach well down over the pubes without tension. Both limbs of this coil, which measured about ten inches, were ligated and severed from the remaining small intestine, upon which clamps had been placed, and the ligated ends invaginated with silk sutures, the free ends of the ileum being united end to end by simple sutures. The mesentery attached to the distal (cæcal) half of the isolated loop of intestine was now ligated and divided, so that there should be no tearing of the mesentery when the loop was drawn down to the vulva, and so that the site of anastomosis would not be dragged down into the pelvis and thus predispose to kinking

(Fig 1) Long forceps were now passed up through the space between the bladder and the rectum by an assistant, and the piece of intestine which had been severed from its mesentery drawn out through the vulva. The vesical peritoneum was next sutured to that of the sigmoid around the transplanted intestine, and the wound in the anterior abdominal wall closed. The patient was again placed in the lithotomy position, that part of

FIG 1



Segment of ileum (C E D) isolated, the ends C and D ligated and invaginated and the mesentery along the distal half (from C to E) tied and cut. The end C was drawn out through the space between the bladder and rectum, the bowel at E attached to the vulvar orifice, and the excess (from E to C) cut off. The ends A and B were united by end-to-end anastomosis.

the ileum lying against the opening in the bladder fixed in position with catgut sutures, thus closing the fistula, the intestine protruding from the vulva (*i.e.*, that portion which had been severed from its mesentery) cut off, and the open end of the intestine sutured to the vulvar orifice. The new vagina was filled with gauze, so as to press its walls against the walls of the space between the bladder and the rectum.

The convalescence of the patient was uneventful, except that after a few days urine began to trickle from a small opening just below the urethral orifice. One year later the vagina admitted the index and the middle fingers for their entire length, and was performing the function for which it had been designed. Although there was still some leakage of urine the patient expressed herself as satisfied with the result, and refused further interference for the repair of the fistula.

The earlier operations for the formation of an artificial vagina were among the most unsatisfactory in surgery. The new canal would almost invariably become obliterated or useless, owing to cicatricial contraction, despite the energetic employment of dilators or plugs. Lining the raw cavity between the bladder and the rectum with epithelial or endothelial flaps or grafts seemed promising at the time of their application, but the ultimate results were failures. Mackenrodt, in two instances, successfully transplanted flaps of mucous membrane obtained during operations for prolapse of the uterus. Others turned in dermal flaps from the neighboring parts (Abbe, Burrage, Beck) or papered the walls of the newly formed vagina with Thiersch grafts. Stoeckel and Von Ott split Douglas's cul-de-sac, drew flaps of peritoneum down to the vulva, where they were sutured, and packed with gauze. When the gauze was removed the vagina contracted. Dreyfus ingeniously made use of a hernial sac.

Gersuny, in 1897, was the first to utilize the rectum, or at least a part of it. He fashioned a pedunculated flap, attached above, from the anterior wall of the rectum, sutured this flap beneath the bladder, and then closed the wound in the rectum. The sphincter ani was cut, so that there would be no constipation and interference with healing. The anterior vaginal wall was thus covered with epithelium, which, it was hoped, would finally extend over the entire raw surface. Two cases were treated in this manner. One had, at the end of ten months, a vagina completely lined with epithelium which admitted the index finger, the result in the second case is not known.

In a third case of the same kind small grafts of epithelium were placed also on the posterior wall of the new vagina. A rectal fistula followed but finally healed, and at the end of five and a half months the vagina measured 9 cm long and 7 cm in circumference. Pupel operated in a similar way, with a rectal fistula and narrowing of the vagina as a result. Amann modified the Gersuny operation by forming the rectal flap into a tube, a procedure requiring an unusually large rectal ampulla. Shubert cut the rectum at each extremity, closed the upper end, displaced the rectum forward, and sutured the sigmoid to the sphincter ani. Four months later the result was satisfactory, except for a tendency to narrowing at the vulvar orifice. Albrecht did the same sort of an operation, except that he used the sigmoid instead of the rectum. Sneguireff resected the coccyx, severed the rectum at its upper part, sutured the lower end of the upper segment of bowel into the wound, thus establishing an artificial anus, and closed upper end of the rectum, which was then used as the vagina. Most writers heap reproaches on this operation, for obvious reasons.

All continental writers, with the exception of De Bovis, give Haberlin (1907) the credit for suggesting transplantation of the small intestine for the purpose of forming an artificial vagina. As a matter of fact, the operation was devised by J. F. Baldwin, of Columbus, Ohio, in 1904, and first performed by him three years later. Since this time he has operated upon three additional cases, using the small intestine in each instance. Baldwin's method consists in opening the abdomen and drawing a coil of ileum down to the vulva by means of forceps, introduced through the space previously created between the bladder and the rectum. The upper ends of the coil are then severed and each end closed by an inversion suture, the continuity of the remaining bowel being restored by end-to-end anastomosis. The abdomen is then closed, the patient placed in the lithotomy position, the loop of bowel, still held with the forceps, opened and sutured to the skin, and each limb of the loop packed with gauze.



Thus there are two vaginas, the septum between which is removed in ten days or two weeks by clamp pressure. In addition to the four cases reported by Baldwin the small intestine has been employed in six instances to form an artificial vagina, thus making ten in all. Stoeckel (1912) and Abadie (1912) each proceeded in substantially the same manner as Baldwin. Mori (1909), Mueller (1910), and Halban (1912) isolated a segment of ileum, closed the upper (oral) end, and dragged the other (cæcal) end down to the vulva, re-establishing, of course, the intestinal canal by anastomosis. It is difficult to understand how, without dangerous cutting or tearing of the mesentery, this dragging down of one end of the isolated segment could be accomplished, unless the site of anastomosis also was dragged down into the pelvis and kinked. In order to avoid this traction on the site of anastomosis, without compromising the nutrition of the bowel, and desiring to construct a single vagina, instead of a double vagina as in the Baldwin operation, we removed a portion of the bowel, as described above. If the uterus had been present we should have sutured the upper end of the transplanted bowel around the cervix.

Of the ten patients thus far operated upon all recovered and secured an excellent result. Stoeckel found that in his case the mucous membrane of the transplant continued to elaborate intestinal juices, and that the amount varied with the character of the food taken into the stomach, thus on an albuminous diet the total quantity of secretions in 24 hours was 62 c.c., on carbohydrates 37 c.c., and on fats 21 c.c. Stoeckel calls attention also to the increased danger of absorption and poisoning if corrosive sublimate, carbolic acid, lysol, or other strong antiseptic is employed as a vaginal douche.

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# THE REDUCTION OF OLD UNREDUCED DISLOCATIONS OF THE SHOULDER \*

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THE best treatment for the old unreduced dislocations of the shoulder is still undecided, although there is probably no question concerning traumatic conditions of the shoulder that has been the subject of more prolonged and earnest discussion. The most definite result that has been attained is the general tendency toward earlier operative interference, the chief advantage of which is that the severe force necessary for the reduction can be applied with less danger of fracture of the humerus and with greater safety to the surrounding important vessels and nerves. But the results of such operations are far from satisfactory, in many cases the reduction still remaining impossible and the operation frequently ending in an excision of the head of the humerus. That nearly all dislocations become practically irreducible after three months, and that they often become very difficult of reduction in as many weeks, is generally conceded. As a medical student I was taught that attempts at reduction should be made up to three months, and that even after that, operation was not of necessity indicated. There was a considerable difference in the views of teachers then as now. Although Kocher<sup>1</sup> operated as early as five and seven weeks in some cases, his record of non-operative reductions has probably never been equalled. He reported 25 successful reductions out of 28 cases, after 5 months and 22 days in the longest and 5 weeks in the shortest. The position taken by Lund<sup>2</sup> 15 years ago probably represents the present general tendency among surgeons as

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well as any According to Lund, "after more than six weeks have elapsed, such changes have usually taken place as to render success, with such manipulative methods as it is safe to employ without danger of fracture of the humerus or rupture of the axillary artery, improbable If reduction is to be accomplished at all, it is to be accomplished by arthrotomy, with or without resection of the head of the humerus" He refers to the "remarkable case of Burrell" in which the reduction was accomplished without operation after eight months Cavaillon,<sup>3</sup> in his report of a case reduced after six months by Jaboulay, says that Koenig reduced one after eight years and Sedillot one after one year without operation. The opinion of the profession generally, at the present time, is probably expressed in the statement of Forque and Reclus, quoted by Cavaillon, to the effect that success by manipulative methods in such old cases made them pernicious examples, evidently, because they encouraged too daring and dangerous attempts by others The axillary vessels have been ruptured in rare instances and the humerus fractured many times Kocher fractured the humerus in the three cases in which he failed to reduce the dislocation, and likewise in one of his operated cases in the efforts to reduce by his method before operation, resecting the fractured head in the operation In another of the operated cases the upper end of the humerus was fractured in attempts at reduction before the patient came to the hospital

It would be generally admitted that the average functional result following a non-operative reduction is better than that following an operative reduction Jonas,<sup>4</sup> in supporting the operative method, says "The division of muscles, especially the deltoid and the subscapularis, has often been extensive and the separation of fibrous and capsular structures extended over a wide area, before reposition became possible" I doubt if as much damage is done to normal structures in the usual reduction by manipulation, so that the return of function should be more rapid and more complete It is very likely, however, that complete return of motion and function is rare even after the non-operative reduction, except perhaps in cases

of two or three weeks' duration. The increased tendency toward operative reduction is to be explained by the almost insurmountable obstacles to reduction in many cases, and the present-day well-developed technic for operations in general. Yet, notwithstanding the very large number of operations which have been done by the best surgeons, we have no reason to be particularly proud, even when the reduction has been accomplished. The mortality of operation has been considerable, while the non-operative reductions have a much better record in this respect. Kocher, for instance, had one death from sepsis in his eight operative cases, but none in his 25 successful and three unsuccessful non-operative cases. In another operative case, a sinus was still present nearly seven years after operation.

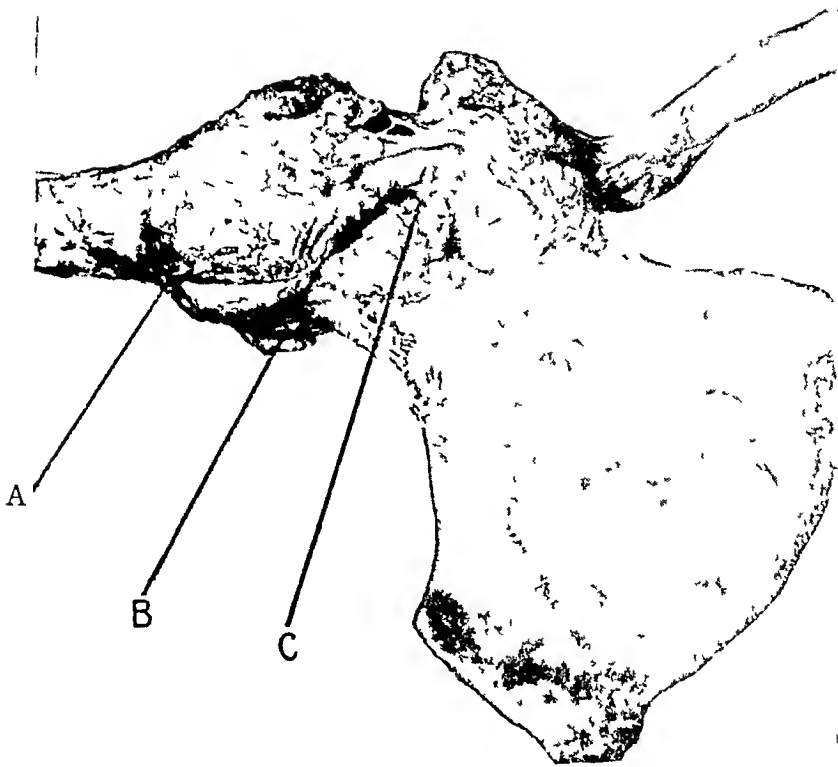
One is apt to underestimate the difficulties until he has attempted the reduction in one of these cases. The humeral head is not far removed from its normal place in the socket. The anterior glenoid margin, in the subcoracoid variety, is in contact with the cartilaginous portion of the head, above and posteriorly, just anterior to the anatomical neck, so that the greater tuberosity is still in the glenoid cavity or directly over it, and only the rounded portion of the head is anterior to the glenoid margin. Yet to bring the whole of the head back into the socket, after a few weeks, is often very difficult. The particular obstacle to reduction has never been satisfactorily demonstrated.

During the last four or five years I have had considerable interest in the results of traumatic conditions about the shoulder, many of which are very obscure. I began early to pay attention to the old unreduced dislocations and to theorize, on the basis of the cadaver dislocations, as to the cause of the difficulties in reduction. The first fact to attract my attention was that the reduction, which is usually very easy under full anæsthesia at the time of the accident, becomes very difficult in two or three weeks, and that without regard to whether the X-ray shows a concomitant fracture or not. To my mind that meant that the obstruction was in the soft tissues. My first conclusion was that it was due to a short-

tion (Fig 3). Without such an incision, the tearing usually takes place from the glenoid or humeral attachment. Since the capsule conditions which Kocher emphasized in his description of the cadaver dislocation tallies almost if not exactly with what I have seen repeatedly in my cadaver work, I believe that his longitudinal incision had only little influence upon the size of the transverse rent which permitted or was caused by the dislocation. As I have seen the laceration of the capsule, its margins cannot become constricted about the neck of the humerus in a recent dislocation. It is too extensive and its transverse direction will not permit it (Fig 4). This view is not original since Professor G. G. Davis taught his classes in applied anatomy at the University of Pennsylvania for more than ten years that the margins of the rent in the capsule would not prevent reduction of a recent dislocation.

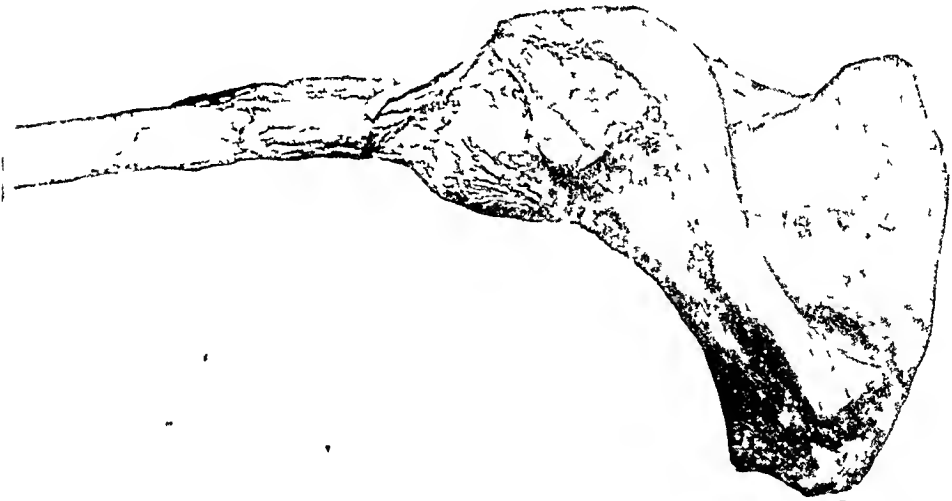
On the other hand I find that the conclusions which I had reached concerning the cicatricial changes in the capsule and upon which I had based my efforts at reduction in my first four shoulders (three patients), did not differ greatly from those which Kocher had reached. The one difference which I regard as important, *ie*, as to the importance of the margins of the rent in resisting reduction by constriction about the neck, has led me to reject the Kocher method of reduction and to employ the old method of abduction, or one of the abduction methods, and because of the good results which I have obtained with it have concluded to report the results of my observations and to support the method which I think is best. While Kocher says that his main contention which concerned the cicatricial changes at the site of the tear in the capsule was based upon his operative cases, it is evident that his interpretation of the effect of these changes was based primarily upon the conditions found in the cadaver dislocations. He assumed, therefore, that the subcoracoid dislocation in the cadaver produced by forced abduction, since that is how he produced it, represents the same condition as the subcoracoid dislocation in life. The work which I have already done on traumatic conditions of the shoulder is based upon the same assumption, with the further conclusion that

FIG 1



Capsule preparation from cadaver dislocation produced by Malgaigne method which was employed by Kocher. View from below and anteriorly. A, B opening made in lower part of capsule by incision, B, C, increase in capsule opening made in producing dislocation by abduction after incision was made. At B the capsule margins were approximated by a suture to indicate the junction of the incised and tear portions of the capsule opening necessary for the occurrence of the dislocation.

FIG 2



Limit of abduction with scapula fixed in normal position (when arm is hanging at side). Axillary portion of capsule tense and humeral head held firmly against glenoid surface. Further abduction will tear axillary portion of capsule.



Same preparation as in Fig 1 showing size of capsule opening produced by the combination of incision and tearing and necessary for the occurrence of the dislocation

FIG 4



all anterior dislocations are essentially the same. The cadaver dislocation, therefore, makes an excellent basis upon which to build up the probable results in life of the later cicatricial changes. In this way I determined to my own satisfaction the pathology of the recurrent dislocation, and upon this basis have now operated on 12 cases and have assisted in another, with only one recurrence of the dislocations. I believe that there is very little difference between the capsule conditions developing in the recurrent and the old unreduced, except that in the latter the continuance of the dislocated position has permitted the capsule about the humeral head to become firmly fixed in its abnormal position. In both conditions the capsule is completely repaired, but to meet abnormal conditions, *i e*, to permit the humeral head to occupy the dislocated position. Kocher "found no capsule tear anywhere" in his autopsy but "a closed fibrous tissue covering passed over the head everywhere." No one has yet reported that he found the tear unhealed in an operation on a recurrent dislocation.

In my effort to locate the obstructing portion of the changed capsule, I have taken for the type, as did Kocher, the dislocation without fracture, in which the upper and posterior portion of the capsule was not torn. With the head in the abnormal position, the lacerated capsule would, of necessity, adapt itself to the altered relations of the articulating surfaces and this rearrangement can be observed on the cadaver (Fig 4). When the tear is from the glenoid margin, which is probably the most common variety, the torn portion of capsule attached to the humerus maintains about its normal relation to the head as does the capsule to the neck and head of the femur in the corresponding condition in the hip (as shown by Allis<sup>6</sup>). The head of the humerus protruding at the site of the rent, but not completely through it, separates the upper torn edge of capsule from its normal place at the glenoid margin, so that later when the gap has been filled in by new cicatricial capsule this portion of the repaired capsule is longer than normal by the width of the gap. Therefore, the obstruction cannot come from this portion of the repaired capsule. The posterior portion, which is dragged



tensely over the glenoid cavity by the head in its dislocated position, will be kept continuously at its normal length so that, because of its length and the fact that it is not put under tension in the reduction, it will not resist the return of the head to the socket, unless it becomes adherent to the glenoid surface as Kocher found in one of his operated cases. Even if it does, the traction on the humerus in abduction might separate it during the reduction. But in the regions between these two portions the capsule conditions are not so favorable to reduction. The undamaged portions at the upper and lower limits of the rent pass forward and inward with the head, so that instead of having a vertical direction as in the normal condition they now are about transverse, and as Kocher showed for the upper portion are rolled somewhat into a cord (Fig 5). Cicatricial tissue fixes them to the corresponding portions of the scapula, the upper portion near the base of the coracoid process and the lower portion near the bottom of the glenoid cavity. I believe that these two portions of the capsule must be torn more or less before the head can be brought back to the socket, and that it will require considerable force to tear them.

I had determined that traction on the humerus at about a right angle with the trunk, firm fixation of the scapula, and traction or direct pressure on the head toward the socket was the safest and best method of breaking this resistance, but was still concerned about the risk to the axillary vessels and nerves. I knew that severe force had been applied by a variety of methods in a large number of cases, and that vessel rupture, at least, was very rare. A study of the normal relations and those of the dislocation on the cadaver gave some interesting results in connection with this phase of the subject. Normally, the capsule is practically completely covered by the short rotators. With the exception of the circumflex, none of the large vessels and nerves lies directly in contact with the capsule, the circumflex nerve and posterior circumflex vessels being in contact with a small portion of it near its humeral attachment. In an anterior dislocation, the humeral head passes downward and forward, and overlaps

for a short distance the glenoid margin but still remains under the subscapularis, which continues to separate it from the large vessels and nerves. These are adherent to the upper surface of the muscle, and do not move with the head when it is being luxated, so that they come to occupy a position anterior to the dislocated head, and in my opinion are not in danger from direct pressure on the head toward the socket, if that pressure is made over the most prominent portion of the head and from a position somewhat posterior. Kocher emphasized the danger to these structures from the heel in the axilla in the Cooper method, which seems to have been the most popular one in recent dislocations up to that time, and it is this danger which was probably the most important factor in obtaining for the Kocher method the rapid and extensive recognition which it received. While they should always be respected, I believe that the danger to the vessels and nerves has been over-rated, especially when the arm is in abduction. I have now operated on two cases of recurrent dislocation of the shoulder through an axillary incision behind the large vessels and nerves, reaching the capsule in the space between the lower border of the subscapularis and the adjacent border of the latissimus dorsi. With a little traction upward on the subscapularis I came directly upon the most prominent portion of the head. This was maintained in the dislocated position to bring it nearer to the surface. The large vessels and nerves did not come into view at any time. The circumflex nerve and vessels were below the most prominent portion of the head in both cases, but in one the subscapular branches of the axillary vessels lay almost directly over the prominence. Although much direct pressure was made on the head in the reduction, in all my cases, in some of them very severe, not one complained of any disturbance that would indicate any damage to vessels or nerves. If the subscapular vessels came in the line of pressure, either they could tolerate very much pressure without suffering or they moved away as the pressure increased, as could easily happen, since the comparatively thick subscapularis muscle intervenes between the vessels and the humeral head. In view of these

observations, the large number of reductions and attempts at reduction in old dislocations with severe force and the infrequency of nerve or vessel rupture, I believe that usually dangerous involvement of the nerves and vessels in the cicatricial tissues does not occur. Guibe<sup>7</sup> studied the lesions of the axillary vessels complicating dislocations of the shoulder, with special reference to the treatment of these complications. He says that it is difficult to determine their relative frequency, that they are very rare but not exceptional. Hennequin did not mention them in his treatise on dislocations, which shows, Guibe thinks, that he had no personal experience with them, although he probably saw and reduced more dislocations of the shoulder than any other man in France, at least old dislocations. Of the 78 cases collected from the literature by Guibe, it appears that in only 31 were the axillary vessels ruptured during attempts at reduction of old dislocations, and most of these were of six weeks' duration or less. In the remaining cases the complication occurred at the time of the dislocation or of the reduction immediately afterward. With the abduction method which I have employed there should be the least danger, because by it the head is dragged back to the socket by the shortest and most direct route. Kocher in describing the findings in his autopsy case said that the nerve cords and vessels were somewhat removed from the head. I searched several museum collections for a wet specimen of an old dislocation but failed to find one.

To formulate a theory is one thing, to apply it in the presence of danger is quite another. I was prepared, however, to test it when the opportunity came. I wish to acknowledge here that I was further prepared by a statement made by Professor Edward Martin, based upon his operative experience, to the effect that in his opinion the chief obstacle to reduction was ligamentous. This was the main point in my observations. Soon afterward I again took advantage of his rich experience. In one case after the usual efforts to reduce by non-operative methods, he exposed the joint, and after dividing such obstructing tissues as could be located and after failing to bring the head into the socket by the Kocher

and other methods, under protection of the field of operation, he placed one foot against the axillary border of the scapula and pulled strongly outward on the arm in abduction, with immediate reduction of the dislocation. While the head had been considerably mobilized by the operation, to my mind, it was of much importance that the abduction method succeeded after the Kocher and other methods had failed. I valued this encouragement the more when I found that in my first case the dislocation had existed for eight months, and that an unsuccessful effort at reduction under ether had been made at the end of three months. I succeeded in the reduction only after the use of much force, but the after-course was quite uneventful.

I realize that the superiority of the Kocher method over all others in old as well as recent dislocations has become so firmly established that it will not be an easy matter to obtain consideration for any other. The abduction method, however, is an older one and has done good service in the past. Kocher's success with his method seems to have been greater than any one else has had with it in old dislocations, probably because in addition to knowing it better than any one else he risked more force than most surgeons would employ. His only failures were in those cases in which he could not employ more force by his method after fracturing the humerus. Such success as I have had with the abduction method is to be explained by the fact that I could use enough force to reduce the dislocation in every case without fracturing the humerus. The one failure was not due to inability to reduce but to keep it reduced. It is my belief that it is distinctly superior to the Kocher method in old dislocations, and I have hoped that I could show that it was. In this connection the suggestion of Dr A. C. Wood is most valuable. He said that the principle of the abduction method was exactly the same as that which Allis<sup>6</sup> established for dislocations of the hip. By reversing the steps of the mechanism of the dislocation, Allis merely drags the femoral head back to the acetabulum through the same path by which it reached its dislocated position. Some years ago Dr Allis

The head ascends to a somewhat higher level in old than in recent dislocations, because of the groove made in the head by the pressure against it of the anterior glenoid margin in the dislocated position. The longer the dislocation persists the deeper will the groove probably be. This groove will at least partly explain the fact that the elbow can usually be brought to the side of the body in old dislocations, while in the recent condition it springs away from the side. Since the resistance is in the fibrous connection between the humerus and scapula, if the scapula is firmly fixed, all the force applied in traction is being exerted on the short or holding portions of the capsule, *i e*, exactly where it can produce the best results and the least harm, the resistance offered by these portions of the capsule being the best possible protection against damage to the surrounding structures during the application of the force.

The following is a brief description of the method as I apply it:

Under full ether anæsthesia, I first try to tear some of the resisting capsule fibres by manipulation. The patient is then transferred from the operating table or litter to the floor with several blankets underneath and a pillow for the head. The Allis apparatus, which permits all the traction to be applied to the arm and thus to prevent danger to the elbow and wrist, is then applied. (Two internal angular splints are always available, Figs 6, 7, and 8.) I then take a sitting position on the floor in such a way that I can brace one stockinged foot against the axillary border of the scapula and the other against the upper border, while pulling on the arm in abduction. An assistant kneels alongside the patient below the arm with the thumb or finger of one hand on the dislocated head of the humerus (Fig 6). Another assistant may, with a folded sheet, assist the first in forcing the head toward the socket. My first pulls, gradually increasing in force, test the downward movement of the head. When I think it comes down far enough I maintain the traction and ask the assistant to push strongly outward and backward on the head (Fig 7), and when it seems to pass out far enough I ask him to pull in on the elbow with the

FIG 5



Showing the upper (a) and lower (b) margins of the rent carried to and inward by dislocated head which is rolled outward to show them

FIG 6



Abduction method with aid of two internal angular splints and wet gauze bandage. First step. Fixation of scapula by surgeon's feet while he makes traction on arm held somewhat beyond a right angle. Thumb of assistant's left hand marking position of humeral head the rest of his body being kept as much as possible out of the illustration.



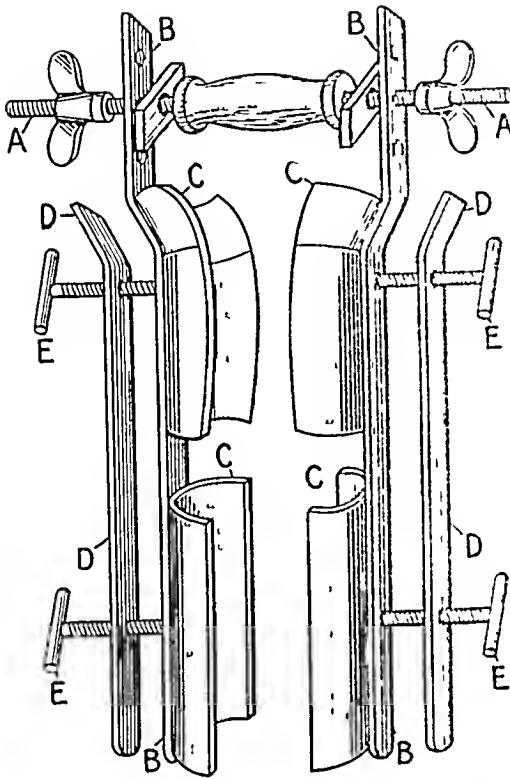
Abduction method. Second step. Head drawn down to level of socket and assistant pushing it toward socket. Folded sheet and second assistant may be employed to aid in this step.

FIG 8



Abduction method. Third step. Assistant while he is still pushing on head toward socket and surgeon maintains traction with his right hand pulls the lower end of the limb to the side of the body.

FIG 9



Allis's instrument for assisting in the reduction of dislocations of the hip. A handle with four nuts to secure handle to upright bars BBBB. CCCC iron plates riveted to BBBB and shaped to fit humerus or femur above condyle. DDDD, movable bars riveted to BBBB approximated to or separated from BBBB. In using the bars DDDD, rest the limb down to BBBB. The bandage is then applied around them and tightened by means of the handles EEEE. Previous to applying the apparatus, a wet bandage should be applied to the limb. It serves a double purpose, in that it protects the part from violence and prevents it from slipping.





other hand (Fig. 8). I have found that because of my position it is rather difficult to move the elbow inward myself. I have not tried the method without narcosis and I have found it difficult to apply the necessary force by grasping the arm above the elbow with my hands. Dr. Allis's apparatus made for applying traction to the thigh in dislocations of the hip, was an excellent aid in the dislocation of the shoulder (Fig 9). I have seen Dr. A. C. Wood, however, reduce a dislocation of about three weeks' duration by grasping the arm above the elbow, placing one foot against the axillary border of the scapula, without taking the patient off the litter on which he was lying, without the aid of pressure or traction on the upper end of the humerus, and without giving an anæsthetic. The reduction was made with the first pull, and the patient merely made a slight outcry and then laughed when he found the shoulder in place. I am satisfied that there would have been more pain if the dislocation had been a recent one.

After the dislocation has existed two or three months, I believe that no non-operative method can succeed without the employment of a considerable degree of force, and in many cases very severe force will be necessary. With the abduction method I have described, I believe that a sufficient degree of force can be safely applied to place the head in the socket in most cases. What time limit or other contraindication the method has, I do not know. In the attempt which I made after four years, I was satisfied that the failure was not due to the duration of the dislocation but to the contents of the glenoid cavity, as the movements of the head were quite sufficient to accomplish the reduction. Kocher found this condition in only two of his operative cases, all of which he regarded as irreducible by non-operative methods. In supporting the non-operative method I have drawn upon the experience and suggestions of those with whom I have been associated. In conclusion I wish to acknowledge an indebtedness that is none the less definite because it is based upon memory. For about fifteen years I had the privilege of seeing or assisting Professor J. William White reduce a considerable number of these old dislocations. I have always believed that he was

unusually successful, and after considerable reading on the subject I have been more convinced of it. His rule was to attempt reduction if the dislocation was not more than three months old, and his failures were very few. In my opinion, his success was due to the fact that he persisted, first with one method, usually the Kocher, and then with another, having assistants make traction with a folded sheet and direct pressure in the axilla on the upper end of the humerus toward the socket, and if the various methods failed after the first trial, going back to one or the other, until finally he brought the head into the glenoid cavity. I believe that every failure brought him a step nearer to success by breaking still more the resistance that must be overcome in every case before the reduction can be accomplished, and that he succeeded because he persisted. I am certain that his success was an important factor in bringing me to the conviction that the solution of the problem in this condition was not in early operation on every case, but that in most cases only the proper method and persistency would be necessary to accomplish the reduction.

The effect of the fractures commonly associated with anterior dislocations of the shoulder is still little understood. They are usually the fractures of the greater tuberosity and the anterior glenoid margin. The tendency has been to regard them as leading to insuperable obstacles to reduction without operation and this was rather encouraged by Kocher. My experience with them is small, but it leads me to believe that in most cases we shall be able to overcome by operation any obstacles arising from them, sometimes with, but often without, operation. Two years after reducing my case of four months' standing I operated and found evidences of both fractures. Codman<sup>8</sup> recently found small fragments of the tuberosity adherent to the glenoid cavity, interfering with the reduction, and he has suggested that in operating on these cases the incision should be made posteriorly. This is undoubtedly true, because by the anterior incision one cannot obtain a good exposure of the glenoid cavity, since the humeral head is in the way. I believe, however, that the capsule resist-

ance should first be broken by traction in abduction, so that when the glenoid cavity is emptied the head can be brought easily into the socket. It might be possible to divide the obstructing portions of the capsule through the wound, but I think it unlikely that it can be done as effectively as by traction on the humerus and fixation of the scapula.

## CASES

CASE I—Woman, fifty years of age. Dislocation of right shoulder, reduced 8 months after accident. Unsuccessful attempt made at end of three months.

Mrs. M., September 3, 1909, fell headlong down a flight of steps, injuring her right shoulder. Physician diagnosed a sprain. Immobilization for a time and later given electrical treatments and massage. Dislocation recognized three months after accident, and attempt made at reduction under ether. Some months later she came into the hands of Dr. J. Bernard Mencke, who referred her to me April 21, 1910. On April 29, she was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on May 2, which was one week short of eight months after the accident, she was etherized and after breaking up some of the axillary resistance by manipulations, I had her placed on the floor on blankets with a pillow under her head. The scapula was fixed by two long strips of adhesive plaster about three inches wide, one passing over the upper and the other over the axillary border of the scapula, and the ends of each strip held by an assistant. One of these assistants placed his stockinged heel against the head of the humerus. I sat on the floor in such a position that I could pull on the forearm just above the wrist with the arm at slightly more than a right angle with the body. After pulling as hard as I could several times to bring the head down to the level of the glenoid, the assistant pushed with his heel on the head toward the socket and I brought the arm to the side, maintaining my traction in the meantime. After three failures to lodge the head in the socket in this way, I asked another interne to assist me in pulling on the wrist, when the reduction was accomplished. The arm was bandaged in the Velpeau position for three weeks.

and then released entirely Notwithstanding the fact that I had been prepared to use much force, I was concerned particularly about the pressure of the heel of the assistant in the axilla, until on the following day the patient showed little or no discomfort and no signs of injury about the shoulder. At the present time abduction can be carried to about 140 degrees, while external rotation is still somewhat limited She has no pain and can do most of her housework

CASE II—Woman aged sixty years Dislocation of the right shoulder of 4 years and 3 months, and of left shoulder of 4 months' standing Reduction on left side, failure on right side Joint on left side opened 22 months after reduction

Mrs R, in the latter part of April, 1906, fell down a flight of stairs and injured her right shoulder Did not seek professional advice until two weeks later She then visited a hospital where a dislocation was recognized She was given an anæsthetic and an attempt made at reduction The arm was bound to the side and patient kept in the hospital two weeks, when she was discharged and told that everything would come out all right About the first week in May, 1910, she slipped on a banana peel and fell striking on her left shoulder. About a week later she sent for a physician who diagnosed a dislocation of the left shoulder With his heel in the axilla he pulled on the arm, after which he said that the dislocation was reduced The arm was bound to the side for two weeks, but during that time the bandage was removed every few days and the shoulder massaged Dr Mencke, at the German Hospital, in the service of Dr G G Ross, who saw her some time later, referred her to me, August 8, 1910, with the diagnosis of a double subcoracoid dislocation, which was readily confirmed on examination and by the X-ray She could abduct to about 120 degrees on the right side and the usefulness of the limb was very good considering the presence of the dislocation On the left side she could abduct to about 50 degrees She was admitted to the University Hospital August 9, 1910, on the service of Professor J William White, and on August 10 was given ether for the attempt at reduction She wished me to try to reduce the right shoulder if I succeeded with the left After placing her on the floor as in the preceding case, a folded sheet was passed around the body transversely so that it covered the axillary border of the scapula and could

be held at both ends by an assistant on the opposite side of the body. Another folded sheet was similarly placed but with its middle over the upper border of the scapula and its two ends passing obliquely downward and to the opposite side of the body where it could be held by a second assistant. In my stockinged feet I sat on the floor in the same position as in the preceding case, but placed one foot against the upper and the other against the axillary border of the scapula, and again grasped the patient's left forearm just above the wrist, an assistant taking hold of the arm just above the elbow. We two then pulled on the arm while the scapula was fixed by my feet and the sheets, until a slight tearing sensation was felt—it was also heard—and the head moved downward to what I thought was the level of the anterior glenoid margin. The assistant holding the sheet passing obliquely downward from the upper border of the scapula then placed one stockinged foot against the upper end of the humerus and pushed the head toward the socket. When it seemed to be in the socket the arm under traction was brought to the side of the body. After two such trials the dislocation was reduced on this, the left side, after having existed for four months.

The right shoulder was treated in the same way but after four or five trials the dislocation was not reduced. There was distinct crepitus, and the X-ray, according to Dr. Pancoast, the skiagrapher, showed a fracture of the greater tuberosity. The head was carried repeatedly over the anterior glenoid margin well up into its normal position, but as soon as the traction and pressure were released it jumped back again into the dislocated position. I am satisfied that the posterior portion of the capsule was adherent to the glenoid surface, probably with a detached fragment of the greater tuberosity so that the cup was filled and the head could not remain in the socket. Kocher called attention to this condition, and other writers, as Lund, have emphasized it. Before the head can be placed in its normal position, the glenoid cavity must be cleared of these structures.

While the force employed in the attempt at reduction in the right shoulder of this patient was greater than in either of the two other shoulders, the left in this case and that of the first case, which were successfully reduced (or in any of

the three successful reductions which followed), it seemed to me that the glenoid conditions and not the prolonged period during which the dislocation had lasted were chiefly responsible for the failure. I would infer, therefore, that while the duration of the dislocation is of importance, the adhesion of the posterior portion of the capsule, especially if it has been detached with a fragment of the greater tuberosity, is of far more importance. After failing to reduce the right shoulder, I bandaged both arms to the side of the body and supported both wrists in slings from the neck. On the following day I removed the bandages and asked the patient to abduct the right arm as far as she could and found that she could do so to about 90 degrees. I asked her if she had much pain in this shoulder and her answer was, "not much." During the night she had had considerable pain in the left shoulder which was reduced, but this had largely disappeared. I had expected to find considerable disturbance, especially in the right shoulder, but there was no noticeable swelling or pain and she permitted me to handle both shoulders, but the right particularly, with considerable freedom.

She left the hospital August 15, and received massage and passive motion at the German Hospital, under Dr. Ross's direction, over a prolonged period. I saw her again for the first time about a year after her discharge. I was surprised to hear her refer to the arm of the side on which I had reduced the dislocation as her "bad arm." The motion was not as good as on the right side where the dislocation remained unreduced, and she had some pain in the left when she tried to move it upward. She was very anxious to increase the movement on the left side. I at first counselled against operation, but as she was a widow and could keep out of the almshouse only by earning her own living, and was anxious to have something done, I concluded to open the joint. The X-ray showed irregularity at the site of the greater tuberosity, and I thought I might find a loose fragment or irregularity, the removal of which would warrant an operation.

She was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on June 15, 1912, with the patient under ether, I made an incision over the greater tuberosity downward and forward from the anterior margin of the

acromion in the line of the fibres of the deltoid. The site of the subacromial bursa was exposed thoroughly but it had been obliterated. In its place was a layer of fibrous tissue about one-half inch thick, firmly adherent to the greater tuberosity but not to the under surface of the acromion, as was shown by the fact that the tuberosity and the layer of fibrous tissue moved freely under the acromion. In this case, at least, the obliteration of the bursa by adhesions was not responsible for the scapulohumeral limitation of motion. With the finger in the joint later it seemed evident that the limited abduction was due to the tightening up of a contracted axillary portion of the capsule. An incision was made into the joint between the supraspinatus and subscapularis tendons, careful search being made for the long tendon of the biceps, which is in this situation. It was found to have been torn from its attachment at the upper margin of the glenoid, and its torn end was adherent in the lower part of the bicipital groove, the upper end of the groove being obliterated by callus. There were two small bony projections on the upper surface of the greater tuberosity, evidently the result of an old fracture which had reunited. There were no loose pieces of bone here. The bony projections were smoothed off by a chisel. The finger in the joint found a deep groove in the cartilaginous portion of the head just below and internal to the greater tuberosity. The anterior glenoid margin, including about the anterior third of the cup, had been worn away. Imbedded in the anterior portion of the capsule was a small fragment of bone, evidently torn from the anterior glenoid margin at the time of the dislocation. The groove in the head had rested on the worn portion of the glenoid margin during the four months in which the dislocation had remained unreduced, and the wearing away in both bones was the result of the pressure induced by the contact. By manipulations during the operation it seemed evident that the absence of the anterior part of the cup and the groove in the head permitted an abnormal range of movement out of the cup anteriorly, and that the rubbing of the rough portion of the head on the anterior glenoid margin in this abnormal movement was responsible for much of the pain which the patient had experienced. The condition found in the joint explains in a measure why it is so difficult to obtain



full function after the reduction of an old dislocation. The operation, however, did not improve the condition of the patient materially, and she is compelled to remain in the almshouse because of the condition of her two shoulders. The pain, however, on movement of the joint is not as severe as before the operation, and the patient is still improving in that respect as well as in the range of motion.

CASE III—Young man. Fracture lower third of right humerus and dislocation of same shoulder, of eight weeks' duration. Weak union and refracture of humerus. Reduction of dislocation. Death of patient three months later from lung disease.

Mr. D., referred by Dr. W. S. Cornell, November 9, 1910, while at work in a lumber yard, a pile of boards fell on him. He was taken to a hospital where a fracture of the humerus was diagnosed and the arm immobilized with splints. He was admitted to the University Hospital January 3, 1911, on the service of Professor Edward Martin, when I saw him for the first time and recognized a dislocation which Dr. Cornell had already found. He was etherized January 5 for an attempt at reduction. I was anxious about the character of the union at the seat of fracture, because Dr. Cornell reported that the patient had come to him with a very indifferently applied bandage and a very small internal splint and with no fixation of the elbow or shoulder.

I gently rotated the arm externally and on the first movement a refracture occurred. I concluded, however, to try to reduce the dislocation. It would have been impossible with the Kocher method. I first applied to the forearm a wet gauze bandage, following a suggestion of Dr. Allis. I then padded with cotton and covered with a gauze bandage two ordinary right-angled internal splints, which I applied to the forearm and arm with another wet gauze bandage after soaking the splints in water. One splint was on the inner and the other on the outer side with the padded side of each splint facing the limb. The upper edges of the splints were left free of bandage just on the forearm side of the elbow. The object was to devise an apparatus with which I could make a strong pull that would be confined as much as possible to and in the axis of the humerus, beside providing some immobilization for the fracture. I had

found that by grasping the arm above the elbow with my hands, I could not apply the necessary force, and in the preceding cases I had been concerned lest the traction on the forearm would do some damage to the elbow and wrist. I learned later that Dr. Allis had devised an excellent apparatus for a similar purpose in hip dislocations that is quite as effective at the shoulder and that I used in the last of my cases. With the patient on the floor under ether I took the same position as in the preceding cases, placed one stockinged foot against the axillary border and the other against the upper border of the scapula, and grasped the splints one in each hand where they were free of bandage. A folded sheet was passed around the upper end of the humerus and the two ends grasped by an assistant who placed one foot against the upper border of the scapula. A second assistant placed his hand against the head of the humerus in the axilla. When after pulling on the humerus and watching the hand of the assistant on the humeral head descend as far as I thought necessary, I asked the assistant with the folded sheet to pull and the other to push outward on the humerus toward the socket while I maintained the traction on the humerus. When the head seemed to be going out satisfactorily, I asked the assistant with his hand in the axilla to grasp the elbow with his other hand and pull it toward the side. The first try failed but the second succeeded. The fracture of the humerus was immobilized by an internal angular splint and a shoulder cap, and the arm bandaged to the side of the body.

The ease with which the humerus was refractured eight weeks after the accident gave little hope of firm reunion, so that on January 30, the site of fracture was exposed by an intermuscular incision on the outer side of the arm. The musculospiral nerve was turned aside, the fibrous covering of the fragments curetted away, and the fracture splinted with a Lane plate, a small rubber dam drain being left in the lower angle of the wound. A dressing was applied and an internal angular splint used to reinforce the plate. The shoulder was then exposed for the removal of two small fragments of the greater tuberosity which were loose. The long tendon of the biceps retained its normal attachment, and the supraspinatus tendon from which the fragments were detached was sutured to the

fibrous covering of the humerus. A small opening was made in the posterior part of the joint for drainage of the oozing that could not be controlled. The wound was closed and a dressing applied. A triangular splint was fixed in the axilla and kept the arm at nearly a right angle with the body. Both drains were removed on the third day. Healing occurred by first intention. The patient developed a severe cough after the operation. He gradually improved and left the hospital March 7. The shoulder was in good position and the motion improving. He visited me at my office several times but about a month after leaving the hospital I lost sight of him. He was much pleased with his progress at that time but his cough was still severe. I learned later that he died about three months after the operation. Before operation he had a pale sallow complexion, but he had not complained of being sick and examination did not develop any lung or other lesion. He did not show lung disturbances after the etherization and reduction. I think, however, that he must have had a latent tuberculous lesion in the lung, and that the ether and shock of the operation made it acute.

CASE IV—Woman, aged fifty-eight years. Dislocation of right shoulder, 16 days old. Reduction.

Mrs. B., on August 20, 1911, fell down three steps, striking on her right shoulder. A dislocation was not recognized until 15 days later. She was admitted to the University Hospital, September 5, on the service of Professor Edward Martin. On the day, an interne made a vigorous effort to reduce by the Kocher method under nitrous oxide anæsthesia, without success. On the following day under ether anæsthesia, I reduced the dislocation easily, with the abduction method, probably because the resistance had been largely broken up by the interne's efforts. The X-ray showed a large fragment of the greater tuberosity widely separated from the head, a condition which, according to Kocher, renders the dislocation irreducible by his method. This probably accounted for the interne's failure. I feared that this fragment would give trouble later from faulty apposition, which fear was not removed by the skiagraph. On September 13, I exposed the greater tuberosity by a three-inch incision downward from the acromion and found that the fragment had fallen so nicely into place that I could find the

line of fracture only on one side and could not detect any irregularity at the site of the tuberosity. The wound healed by first intention and the patient left the hospital on the seventh day after the operation. She now does all of her work as a housekeeper and there is now very little limitation of movement. Her only complaint is that she cannot button her dress in the back quite as well as with the other hand.

CASE V—Woman, aged fifty-six years. Dislocation of right shoulder 25 days old. Reduction.

Mrs. B., on January 1, 1912, tripped over a piece of carpet to the floor, injuring her right shoulder. The physician who was called thought she was suffering from a fracture and said it was a hospital case. I saw her first January 23, and on January 26 I reduced the dislocation under ether at the University Hospital, on the service of Professor Edward Martin, by the abduction method as in the preceding cases. In this case I employed the apparatus devised by Dr. Allis for applying traction to the hip in dislocations of the hip. It worked perfectly at the shoulder, and permitted all the force to be applied directly to the upper arm. The handles allowed an excellent grip with both hands and easy manipulation of the arm. I did not use a folded sheet, but had an assistant make direct pressure on the head toward the socket, and when it had been forced outward far enough he pulled the lower end of the arm to the side of the body with his other hand. The reduction was accomplished on the second attempt. The arm was bound in the Velpeau position and the patient sent home the same day. I did not see her again for four weeks because she had been ill at home. With the permission of Professor G. G. Davis, she received passive exercises and massage in the gymnasium of the Orthopaedic Department of the University Hospital. She now raises her arm above her head and is well pleased with the use she has of it. She reported by letter, recently, that she was enjoying very good use of the arm.

#### CONCLUSIONS

The mortality is lower and the average functional result following a non-operative reduction is better than following an operative reduction, but the frequently insurmountable

obstacles and the great force necessary to a successful reduction have led to an increasing tendency toward operation

The particular obstacle to reduction has never been satisfactorily demonstrated. While Kocher emphasizes other obstacles, as irregular bone formation, his main contention was that the chief resistance to reduction came from the contraction of the margins of the old capsule tear, which had closed about the head and thus prevented the raising of the capsule from the glenoid so that the head could not enter. On the basis of cadaver studies supported by clinical evidence, I believe that the chief obstacle is to be found in the cicatricial tissue at the site of the capsule tear and the shortening of the latter in certain portions, which must be more or less torn before the head can be brought back into the glenoid cavity. The rent in the capsule *per se* is probably never an obstacle to reduction by constricting the neck of the humerus and thus preventing the return of the head.

The Allis principle of reduction is a safer and more effective one than that of Bigelow. According to the former the humeral head is dragged back to the socket in almost a direct line, while by the latter the head is returned by leverage. Kocher, out of 28 cases in which he attempted reduction by his method, reduced 25 and failed in 3, in each of which a fracture of the humerus prevented further efforts. The longest duration of the dislocation was 5 months and 22 days. Of 6 dislocations in 5 patients, 5 were reduced by the abduction method, one of them after 8 months. The humerus was not fractured by the efforts at reduction in any case. While a fracture of the humerus renders an old dislocation irreducible by the Kocher method, one dislocation was reduced after 8 weeks by the abduction method in the presence of a complete fracture of the humerus at the junction of the lower and middle thirds. In the one case in which the abduction method failed, the dislocation had existed for 4 years and 3 months, and there was probably an adhesion in the glenoid cavity of the posterior portion of the capsule with a fragment of the greater tuberosity, a condition which

Kocher considered an insuperable obstacle to reduction without operation. Probably the best method of accomplishing reduction in such a case is first to break the fibrous resistance to reduction by the abduction method and then through a posterior incision to raise the fragment and capsule from the glenoid, when the head can be brought into the socket and the fragment replaced in its normal position, or it may be removed and the remaining capsule sutured in its normal position.

Because of the pressure and other changes in the humeral head and glenoid cavity from the long existence of the dislocation, it will sometimes be best to allow the dislocation to remain unreduced, especially if the limb is fairly useful and without troublesome pain, as in the shoulder in which the abduction method failed. While there was no mortality in Kocher's 28 cases in which no operation was done, in his 8 operative cases there was one death from sepsis. In the 5 cases in which the abduction method was employed without operation, there was no death, but in the case in which there was a poorly united fracture 8 weeks after the occurrence of the dislocation, the fracture was splinted 15 days after the reduction. A latent lung infection, not recognized at the time, was much aggravated by the operation, and the patient died in consequence of it three months after the operation. The indications and contraindications for the abduction method can be determined only by further experience.

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# CHRONIC (NON-SUPPURATIVE) HEMORRHAGIC OSTEOMYELITIS.

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SYNONYMS—(A) Medullary giant-cell sarcoma (B) Myelogenous giant-cell sarcoma (C) Myeloma (D) Medullary giant-cell tumor (Bloodgood)

THE writer has been of the opinion for some time, as the result of a critical study of the literature bearing upon the subject, and of considerable observation of surgical diseases affecting the bones and joints, that the lesion to be described, which has thus far been classified as belonging to the group of neoplasms, is incorrect, and that the terms employed for its description and classification do not properly convey its true nature. In other words, the terms now used for the lesion are misleading, and, therefore, misnomers. The disease occurs in or near the ends of the long bones, and is known under the titles of slow-growing medullary giant-cell sarcoma, myelogenous giant-cell sarcoma, myeloma, and medullary giant-cell tumor. It should be in the group of surgical diseases, classified with the inflammations, or granulomata.

Heretofore the diagnosis of this condition as one of tumor formation has been based, in a measure, upon the presence of a steady, slow increase in size and expansion of the end of the long bone involved. Buerger believes this expansion is more apparent than real, which on section exhibits within the bony shell surrounding it a mass having the general appearance of foreign growth.

The principal reason, however, for giving the lesion its title of medullary giant-cell sarcoma has been based upon the microscopic findings. The histological picture usually shows a microscopic field abounding in giant cells with no architectural uniformity, arrangement, or consistency, they exhibit no limiting boundary, and are invasive in all directions. It is this

microscopic picture of apparent giant-cell riot that has been the main factor in giving to the lesion its title of medullary giant-cell sarcoma, and the sheet-anchor upon which the diagnosis has been based

It should be borne in mind that these giant cells are not tissue builders, nor causes of tissue necrosis, they are wanderers, and act as scavengers in their efforts to take up and consume, or cause the disappearance of, detritus, resulting from injury or death of tissue. According to Mallory, these giant cells are similar to those found in other pathological processes involving bone. He thinks the evidence is sufficient to demonstrate that these are not tumor cells at all, simply foreign body giant cells. He believes that the osteoclasts which occur in connection with bone under normal and pathological conditions are unquestionably foreign body giant cells originating from fused endothelial leucocytes.

Hertzler believes the diagnosis of sarcomatous growths cannot be made from the microscopic findings. He states "It must be recognized that there are no positive microscopic signs of sarcoma, it becomes necessary to resort to other evidence than that of the microscope, such as the history and macroscopic appearance of the growth."

Bland Sutton, using the British title given to these lesions (myeloma), states. "A close study of myelomas indicates that they differ histologically, pathologically, and clinically from sarcomas, with which they have been hitherto grouped. Microscopically this tissue abounds in large multinuclear cells (giant-cell myeloplacques) embedded among round and spindle cells, the giant cells are so numerous as to constitute the greater portion of the tumor."

Bloodgood concludes that it might be well to drop the term giant-cell sarcoma, as it gives a wrong impression of its malignancy, and suggests the name of giant-cell tumor, he also thinks there may be some relationship between this pathological lesion and the conditions known as *ostitis fibrosa* and bone cysts, both of which are usually classified as inflammatory. The gross pathological or naked-eye appearance of so-called medullary giant-cell sarcoma, observed as a single slow-grow-



ing lesion in the ends of the long bones, has a most striking and typical aspect that should not be mistaken for anything else when seen in the fresh or during operative interference. After section of the tissues leading to the involved area of bone structure, one is impressed with the general character, appearance, and consistency of the pathological lesion the picture presents.

The mass has a fresh, glistening, reddish appearance that looks like, and really is, very exuberant embryonal granulation tissue and highly vascular. Many of the vessels apparently run in continuity with those of the normal surrounding tissue. The vessels, being without supporting structure, become greatly dilated, and sometimes pulsation is felt throughout the vascular granular mass.

Scattered throughout the vascular granulation tissue may be seen numerous rounded hyaline bodies, varying in size from a grape-seed to that of a pea, these bodies are probably degenerated blood-clots or thrombi. Bloodgood speaks of finding whitish areas of *ostitis fibrosa* within the mass, these areas are evidence of more active focal points of inflammatory reaction. Within the cavity is usually found more or less hemorrhagic fluid. Just how much of this fluid is native to the lesion or how much of it is due to bruising the granulation tissue is hard to say. Exploration at primary operation does not give evidence that any suppurative process ever has been present or is going on. The tissue is very friable and has somewhat the appearance described by the German observers as that of red-currant jelly. Bland Sutton describes the lesion as having the look of a piece of fresh-cut liver. Bloodgood thinks the consistency of the mass to a certain extent resembles "Schmierkaes." I think that when red bar-le-duc is added to the cheese the resemblance is still more striking.

There is an undefined smooth velvet effect the tissue gives that is difficult to describe, it is soft and oozes freely on touch, a microscopic and at the same time gelatinous, its color has the general uniformity of a very ripe strawberry, and the consistency of limiting boundary, as one of that seen on section of brain at recent

autopsy This picture differs in many respects from any form of tumor growth, but is rather typical of large masses of exuberant, highly vascular granulation tissue

The lesion practically always occurs in or near the ends of the long bones To this region Ollier gave the term "the zone of election of pathological processes"

The term osteomyelitis is generally confined to a condition defined as an acute suppurative infectious process beginning in the marrow of the alveolar spaces in the diaphyseal ends of the long bones The disease is most often seen in children and in young adult life, it follows injuries of moderate or even slight severity

The clinical picture and forms vary The most frequent site of the lesion is in the upper end of the tibia According to Haaga's statistics, 42 per cent of all cases of osteomyelitis occur in this region, and 39 per cent in the femur, usually the lower end Besides the acute infectious suppurative form most commonly met with, Ollier first described acute and chronic non-suppurative forms of inflammation of bone, to which he gave the term *periostitis aluminosa* The researches of Jaksch, Schlange, Graser, and others indicate that the process is an infective one, that gives no evidence of suppuration Dennis states that "all the conditions resemble in every respect ordinary suppurative periostitis, only the pus is absent"

Tixier believes the probable origin of this form of osteomyelitis is syphilitic

Osteomyelitis following typhoid is usually localized as a small abscess with periosteal thickening *Periostitis aluminosa* gives the same train of symptoms as an ordinary acute attack of infective osteomyelitis, excepting that it seems to progress without suppuration, as does the equally rare sclerosing form Haaga has seen only 20 cases out of 559 osteomyelitic lesions Brodie's abscess is another form of mild infective osteomyelitic disease

The lesion I have termed chronic (non-suppurative) hemorrhagic osteomyelitis gives no picture of acute inflammatory symptoms, it may have and probably has, an acute stage,

but the symptoms are of so mild a character that practically no physical inconvenience is experienced until many months have elapsed from the time of onset of the disease

Chronic (non-suppurative) hemorrhagic osteomyelitis has its inception in the same areas of bone structure as the acute form, the process of bone disintegration is much slower, but just as effective, in cancellous tissue destruction. In the acute form, rapid necrotic and suppurative changes take place as a result of the absorption of virulent toxic substances which have the effect of an almost immediate destructive sequelæ

In this chronic form of osteomyelitis, the process is so slow, due to a probable mechanical-pressure necrosis, that there is no suppurative evidence of cellular death, but abundant proof of attempts at repair and regeneration in the presence of granulation tissue. Going hand in hand, are observed continuous trauma from pressure necrosis, and the death of delicate bony cancellous structure, and regeneration with efforts at repair by the formation of granulation tissue

Adam<sup>1</sup> states that the predominant feature of a chronic inflammation is essentially tissue overgrowth, and more particularly overgrowth of the least differentiated elements of a tissue. Even in the lowest grades of inflammation, it is probable that there is always some dilatation of the blood-vessels, some migration of leucocytes, and some increased exudation, but these may be so slight as to pass unnoticed in comparison with cell proliferation

Granulations that persist as such for a long time, without becoming changed into connective tissue, are seen in the specific infections, these fungoid formations of granulation tissue are frequently termed granulomata. The rôle of the giant cell in inflammatory lesions is important; their appearance in great numbers is an evidence of a low-grade, non-suppurative form of inflammation. They are not observed in the virulent acute inflammatory processes, they are essentially the accompaniment of chronic disturbances. The giant cell takes no part in tissue formation; according to Kolliker, giant cells (myeloplacques, osteoclasts) are formed in the bone-marrow

normally They are found in normal tissue in Howship's lacunae

Ziegler describes their function in part as follows "If dying, or necrotic, portions of tissue are too large to be taken up by the leucocytes or proliferating tissue cells, there often develop in the granulation tissue formed in their neighborhood multinuclear giant cells which arrange themselves on the surface of the foreign body or the superfluous tissue mass in exactly the same manner as in the case with the osteoclasts under physiological conditions If the bodies are not too large they may be taken up by the multinuclear cells, otherwise the cells remain clinging to the surface The giant cell (under certain chemotactic properties caused by injury and low-grade inflammatory conditions) seems to be evolved from the endothelial cells, and possesses phagocytic properties"

Giant cells are found in abundance around ligatures in the absence of visible pus They are also in lesser degree the accompaniment of syphilitic and tuberculous lesions, beyond the neighborhood of necrosed structure

We may conclude that the presence of numerous giant cells is an evidence of a low-grade inflammatory process at which efforts of regeneration are taking place coincident with their presence in the tissues

It is only in low-grade, non-suppurative conditions that the chemotactic properties of the blood call forth their overproduction, and, further, their *sole* function is the removal of injured or dead extraneous products surrounded by or embedded in granulation tissue, they should neither be credited with nor accused of the ability to form tumor growth An overproduction of granulation tissue, the result of more or less constant irritative changes that take place within the bone, should not be regarded as true tumor growth, it would be just as reasonable to call exuberant granulations occurring in the wounds of the soft parts tumors as in these cases The process of repair in bone is slow compared with that of the soft parts, as is evidenced in fractures

If a fracture is complete, there is an immediate extravasa-

tion of blood between the ends of the fragments and torn periosteum, the blood-clot formed makes a connecting bridge, and especially a support, for the new granulation tissue, which later becomes fibrous and bony, forming callus

In the condition under consideration, operative findings indicate that the spaces left by destruction of the cancelli are not primarily filled by blood-clot, but by direct proliferation of granulation tissue. It is possible that granulation tissue remaining as such, and which is more or less continuously proliferating, may reach a stage that will bring about regressive degenerative changes from which the malignant neoplasms arise. In such event, we have a changed clinical, gross pathological, and microscopical picture

Some of the clinical facts regarding osteomyelitis and so-called medullary giant-cell sarcoma are in many respects strikingly similar. In points of distribution of the disease, the ends of the long bones are the favorite site. Von Bruns and Nichols find that osteomyelitis most frequently occurs in children and adolescents, the favorite age in 50 per cent. of the cases being between 13 and 17 years.

In Bloodgood's series of cases of so-called giant-cell sarcoma, and those he collected from the literature, the ages varied from  $2\frac{1}{2}$  to 66 years.

Bland Sutton, who describes the condition under the title of myeloma, states that its occurrence is rare over the age of 25 years.

There cannot be much doubt that chronic (non-suppurative) hemorrhagic osteomyelitis frequently occurs in children as a result of injury to the ends of long bones, and that the reparative processes are sufficiently active to prevent any progressive chronic stage. The condition so often diagnosed by the general practitioner as early tuberculosis of bone, with rapid cures, if more often examined by the X-ray, would be found to belong to this form of osteomyelitis. From the histories recorded, these lesions give the duration of the disease as having lasted from several months to several years. Their increase in size is very slow and spheroidly expansile. It must be very rarely that the mass breaks through its capsule.

A slight trauma can be the starting point of grave osteomyelitic infection, dependent upon the lowered resistance of the host and the virulence of the bacterial invasion, such trauma may also be the forerunner of a low-grade, mild inflammatory process in which destruction is constantly going on and regeneration fails to respond in a sufficiently active way to replace the cancelli with more than a primitive granulation tissue. Should regeneration be sufficiently active to convert granulation into connective tissue, a more advanced stage of the primary process takes place, causing retraction of structure and the development of so-called *ostitis fibrosa*, with or without cyst formation.

Several experiments made by Ullman showed that the application of a temporary ligature to an animal's leg for from 10 to 14 hours resulted in changes occurring in the marrow of the bones, particularly extravasations and circumscribed hemorrhages.

Warren believes that some slight injury, such as a kick given by a playmate, or a sprain, is sufficient to produce in the delicate tissue, with its rich vascular supply, a bruising of the vessels and an effusion of blood, causing a certain amount of damage which interferes with the nutrition of the part. Minute fractures of bony trabeculae are not infrequently found after such injuries.

It is quite easy to understand that destruction of the trabeculae will have a pathologic effect on the venous sinuses that are supported by it, causing thinning of the vessel walls and their dilatation and varicosity, and further leading to transudation and possible rupture. The varicosed and dilated vessels are also a constantly active cause, with the aid of the granulation tissue in which they are enmeshed, in the further progressive destruction of the bony canals from pressure necrosis, and the ever-present low-grade chronic inflammation stimulates the reticulum of the bone-marrow to increased proliferation of granulation tissue.

The clinical diagnosis of chronic (non-suppurative) hemorrhagic osteomyelitis can be made from the age of the patient, from the duration of the lesion (a slow chronic inflammation

round and epithelioid cells and free blood-cells, on one side there is a comparatively large amount of blood-clot. There are no distinct areas of generation, but in the search of a relatively large number of slides a few well-defined giant cells were found containing 8 to 12 nuclei.

The cavity of the bone was packed and occlusive dressings applied, some days later increased temperature was observed and infection noted, the wound continued to discharge for six weeks, when closure took place.

*Comment*—This case is as typical an illustration of a so-called medullary giant-cell sarcoma in the end of a long bone as it is possible to obtain. The patient is rather over the age Bland Sutton pins his faith upon, but in Bloodgood's series the ages range from  $2\frac{1}{2}$  to 66 years.

The duration of the lesion is uncertain, the patient had complained for several years of some radiating pain between the pelvis and knee-joint. Several physicians assured her that the trouble was in the hip. She gave no history of trauma.

It is a question whether or not the correction of the flexion which was done several months before the X-ray picture, which shows the lesion, was taken may not have been the initial traumatic cause of the focal injury in the lower end of the femur. The point is in doubt, because previous to the forcible correction of the flexed knee the joint was enlarged and tender.

CASE II—Pauline D W, female, age  $5\frac{1}{2}$  years. Came under observation at the Hospital for Ruptured and Crippled on the service of Dr W R Townsend four months ago, with a history that two months previously she had fallen or been knocked down, injuring her right elbow. The mother of the child stated that the patient had been under treatment in another dispensary for several weeks following the injury, and that an operation was advised, which she (the mother) declined.

*Examination*—The right elbow showed swelling and tenderness on pressure, with marked pain on rotary movement of elbow-joint. No X-ray was taken, but a diagnosis of osteitis of ulna at the acromial end was recorded, and the arm and forearm put up in a plaster-of-Paris dressing. These dressings have been renewed from time to time. Before each reapplication, the lesion has been examined and improvement noted.



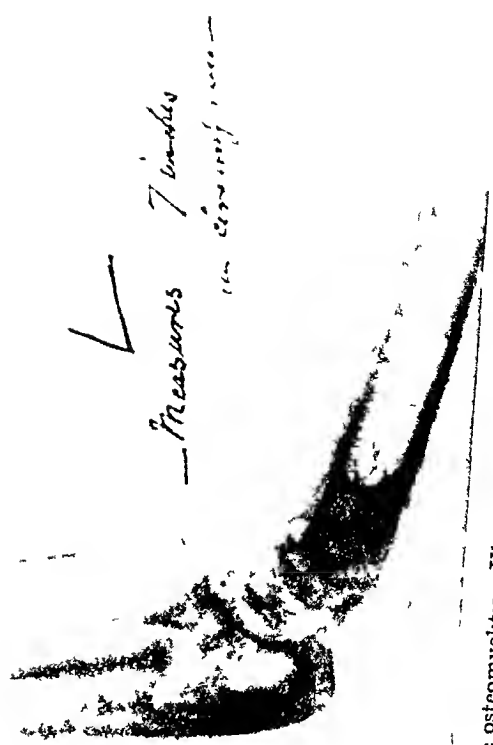


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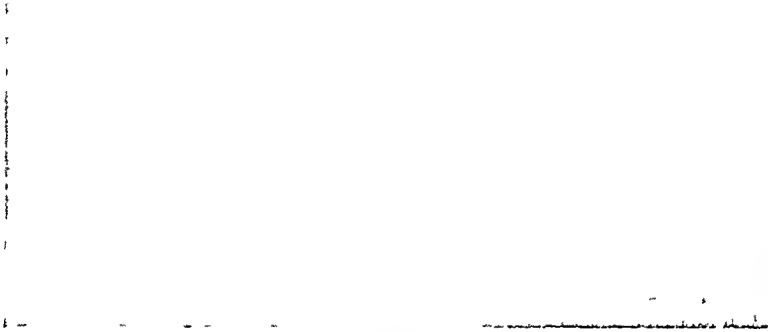
Case 2  
Ulna

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1884



A Normal Chronic (non-suppurative) hemorrhagic osteomyelitis Ulna (Case II)

FIG 3



Tibia, before operation (Case III)

FIG 4



Tibia, six months after operation (Case III)



Final dressing removed three days ago, examination shows practical absence of swelling, circumferential measurement at site of lesion is  $\frac{3}{8}$  inch greater than on opposite forearm, no pain or tenderness, slight enlargement of involved bone, no restriction of motion in the joint

Patient considered clinically cured X-ray (Fig 2) taken two days later shows very clearly the lesion in the acromial end of right ulna

CASE III—Through the courtesy of Dr Henry Ling Taylor I am able to report this case

J O B, white, age 21 years Health good, Neisser infection  $1\frac{1}{2}$  years ago, struck left ankle and became lame 13 years ago One year later pain in front of left ankle, which would come on gradually and last three or four days, resting the leg would make pain pass away There never was any redness or heat in the part, but some swelling in front of the ankle No chills or fever

Wore a brace nine years ago for one year, and was free from pain during that time Since leaving off brace has had renewed attacks like above four or five times a year X-ray shows internal malleolus and adjacent part of tibia enlarged (Fig 3) These are two thin spots in tibia at site of points of tenderness on pressure of ankle

*Clinical Diagnosis*—Chronic osteomyelitis of left tibia near ankle

*Operation* (April 26, 1912) —Bone exposed and cut into, a mass of soft grayish material was scraped out which had filled the cavity now seen above the ankle-joint The bone was chiselled to a depth of more than  $\frac{1}{2}$  inch and a second mass of the same material removed, leaving another space about the size of a bean Wound later became infected, June 13, 1912, well (Fig 4)

These three cases are very instructive, inasmuch as they illustrate the early and late pictures presented in chronic (non-suppurative) hemorrhagic osteomyelitis

In Case I the femur, the earlier stage of the process, is seen with its excessive formation of primitive exuberant granulation tissue and great vascularity coincident with destruction of bony trabeculæ It is the appearance of the lesion

in this stage, with its attendant microscopic giant-cell picture of invasion, that has earned for it the title of medullary giant-cell sarcoma.

Case II, the ulna shows the late stage of the process, in which the granulation has been converted into fibrous tissue, causing retraction and leaving cystic areas, giving the lesion the appearance of the so-called *ostitis fibrosa*

Case III, the lesion in the tibia gives evidence, from its macroscopic appearance, of a late stage of the disease, the mass is described as soft grayish material without sign of necrosis or cysts, solid material encased in bone. The vascular primitive granulation tissue has been converted into structure that apparently is not so densely fibrous as in Case II, is not so firm, and is not cystic, neither is it hemorrhagic, nor has it the naked-eye appearance of Case I. The so-called medullary giant-celled sarcoma and *ostitis fibrosa*, with or without cyst formation, are apparently different stages of the same lesion, the latter being Nature's final effort at repair.

The treatment generally of chronic (non-suppurative) hemorrhagic osteomyelitis should be operative, the operation including only the removal of unhealthy and excessive granulation tissue and inflammatory debris.

The early treatment by fixation in plaster-of-Paris dressing may be effective, the part being put at absolute rest in the same manner that tuberculous lesions of bone are treated, or simple fractures. The insult of operative interference and removal by curettage of the pathologic mass from within its bony cavity stimulates the more active properties of the tissues to regeneration of fibrous cellular tissue structure.

Firm packing or plugging of the wound cavity following operation, causing closure of the dead space, prevents the riotous spreading of soft granulation tissue that occurs in the process of the disease.

The method and technique of Bloodgood is radical and efficient. (Curettage and packing has been the method used in a majority of the cases recorded by the Germans for many years.) The transplantation of a piece of bone into the bony

cavity that remains after removal of the soft pathological tissues, as advised and performed by Bloodgood, is novel and should hasten repair in what is at best a slow-healing process.

The use of the Esmarch bandage for the control of hemorrhage during the operation seems to be a good plan.

The use of pure carbolic acid, followed by alcohol, or of chloride of zinc, to destroy the tissue left behind by the curette, does not seem to be necessary, and must retard the normal healing process. It is better to use the ordinary tincture of iodine for swabbing the cavity thoroughly, it is not destructive to tissue, but, acting as an irritant, stimulates the growth of healthy granulation tissue, which becomes fibrillous and fibrous, retractive and firm, as a result of proper packing or plugging.

If the cavity left in the end of the bone after curetting is not too large, the plumbierung of Mosetig-Moorhof or the bismuth paste of Beck should be used, they act as a plug and control the overactivity and exuberance which granulation tissue frequently assumes in dead spaces, packing the cavity with gauze has the same effect.

The treatment with Coley's serum, or the attenuated streptococcic serum recommended by Wyeth, may have some effect in promoting increased tissue reaction, but the use of either does not seem to be necessary.

The essentials are the application of the ordinary surgical procedures for the removal of detrimental inflammatory products.

Amputation without real evidence of sarcomatous degeneration, which these cases rarely give, is uncalled for.

#### CONCLUSIONS

- 1 The lesions in the ends of the long bones described as medullary giant-cell sarcoma, myelogenous giant-cell sarcoma, myeloma, and giant-cell tumor should not be included in the classification of tumors.

- 2 The process begins as the result of a trauma, and gives all the clinical and pathological evidence pertaining to a low-grade inflammation.

3 The foundation upon which the diagnosis of malignant tumor growth has been based is the presence in the tissues examined under the microscope of numerous giant cells which do not show any uniformity of architectural arrangement or boundary zones. It is an established fact that these giant cells are not tissue-builders, but scavengers, whose function is the removal of débris that is produced by low-grade inflammatory conditions occurring in bone.

4 The whole process is explained on the basis of the lesion being due to a low-grade, ever-present irritation or inflammation, which causes excessive production of vascular granulation tissue masses.

5 From the clinical picture and the gross and microscopic pathology the condition presents, the term chronic (non-suppurative) hemorrhagic osteomyelitis seems a more correct definition of the lesion than the terms now in use.

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# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, Held at the New York Academy of Medicine,  
November 13, 1912*

The President, DR CHARLES L GIBSON, in the Chair

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### ARRESTED DEVELOPMENT OF THE FOREARM FOLLOWING OSTEOMYELITIS IN CHILDHOOD

DR WALTON MARTIN presented a girl, 20 years old, who had been admitted to the Roosevelt Hospital, in the service of Dr Joseph Blake, six years ago. The history obtained was that when she was a year old she had an osteomyelitis of the forearm for which she had been under treatment at the Randall's Island Hospital for five years. The affected forearm was about one-fourth the size of that on the opposite side, and was curved to the radial side. The hand on the affected side was about the size of the hand of a child of three or four years.

An X-ray plate showed that the shaft of the radius was represented by only a small, thin portion of bone, the ulna was fairly well developed, but had grown in a curve toward the radial side.

On December 16, 1905, under ether anæsthesia, the ulna was divided, and an attempt was made to straighten the forearm. The arm was put up in a plaster-of-Paris dressing. The wound healed by primary union, but an X-ray, taken two months later, still showed marked curving of the ulna. On February 7, 1906, a wedge of bone was removed from the ulna, and a V-shaped plastic operation was carried out through the soft parts on the radial side. The arm was then brought into a much better position. The plaster splints were removed after eight weeks and passive motion and massage given two or three times weekly by Dr Bartley. This treatment was continued for several months. The patient soon began to use the hand, which had increased in size so that it is now about one-half the size of its fellow. She was able to use it in sewing and in her daily work. The X-ray showed that the shaft of the ulna was now straight.



Dr Martin called special attention to the marked growth in the hand after the correction of the deformity in the forearm

### TUBERCULOSIS OF THE SHAFT OF THE ULNA

DR MARTIN presented a boy, two and a half years old, who was brought to St Luke's Hospital last August Examination showed that the left forearm was enlarged, the overlying skin being normal The swelling was firm and confined to the ulnar side There was tenderness on pressure over the lower half of the ulna An X-ray plate showed that the lower half of the shaft of the ulna was made up of a large cavity covered by a thin shell of bone The neighboring joints were not involved

On September 4, 1912, an incision was made in the forearm over the posterior border of the ulna Upon exposing the bone, the lower half of the ulna was found to be much enlarged The shell of bone was thick on the ulnar side, thin on the radial side On this side the bone had been perforated, and thin, tuberculous pus filled the cavity and had burrowed underneath the periosteum, separating it from the bone

The lower half of the ulna was removed, leaving the thickened periosteum on the radial side The wound was then closed without drainage, and the arm placed in a plaster-of-Paris dressing The boy made an uneventful recovery, and X-ray plates, taken, respectively, 50 days and 66 days after the operation, showed a rapid regeneration of the shaft The new growth of bone could be plainly seen extending along the side of the preserved periosteum The patient was now able to use the arm in a normal manner and there was no evidence of any disease in the forearm at present

### TUBERCULOUS MESENTERIC GLAND

DR JOHN ROGERS presented a man, 36 years old, who came to the hospital with a history of pain in the abdomen, which had persisted for several months The pain was located to the left of the umbilicus; it was inconstant in character The bowels were constipated

Examination revealed a small, tender mass lying just to the left of the umbilicus\* moved freely with the movements of respiration and y xed to the abdominal parietes An X-ray was taken ved q ly a small mass lying just to the left o ing a calculus in the lower pole of T that seemed most

probable, however, was that of a fecal concretion in a diverticulum of the colon, but upon opening the abdomen the mass proved to be a cheesy lymphatic node of the mesentery. After dissecting it out, it was found to contain a few spicules of calcified degenerated material. The patient's recovery was uneventful.

DR. WILLY MEYER said that several years ago he reported the case of a woman who had been operated on for tuberculous mesenteric glands. She was originally operated on for enlarged glands in the iliac region, which extended alongside the iliac vein down to the groin. These glands had partially broken down and were thoroughly removed. Several months later the patient returned, complaining of severe pain in the abdomen, to the right of the umbilicus, over an area which on examination showed rigidity and tenderness. Upon opening the abdomen, several cheesy and partially calcified tuberculous glands were found in the mesentery of the small intestine, similar to the one described by Dr. Rogers. That patient also made a good recovery and has remained well up to date.

#### TRAUMATIC RUPTURE OF THE GASTROHEPATIC OMENTUM

DR. A. V. MOSCHCOWITZ presented a boy, seven years of age, who was admitted to the Mt. Sinai Hospital on October 7, 1912. Just prior to his admission the child was run over by an express wagon, the two side wheels of which passed over the centre of the abdomen from left to right. The child was in deep shock. The entire abdomen was rigid. No blood was found in the urine.

Measures were taken to overcome the shock, and gradually the boy improved to such an extent that it was hoped that no operative interference would become necessary. On the third day, however, symptoms of intestinal obstruction appeared and could not be overcome. There was marked distention of the abdomen, with movable dullness in both flanks.

Operation, October 11, 1912. A median epigastric incision was made, to which subsequently a transverse incision was added. On incising the peritoneum, a large amount of clotted and fluid blood escaped. All the organs were thoroughly examined, and the only lesion found was a vertical tear in the gastrohepatic omentum, about two inches in length, which was evidently the source of the hemorrhage. The tear was repaired, and barring deep post-operative collapse the boy made an uneventful recovery.

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Examination revealed a small, tender mass lying just to the left of the umbilicus, it moved freely with the movements of respiration and was not fixed to the abdominal parietes An X-ray was taken, which showed quite clearly a small mass lying just to the left of the umbilicus and resembling a calculus in the lower pole of the kidney The diagnosis that seemed most

there was a separate protrusion which could be readily invaginated into the intestine. It appeared to be composed of serosa and mucosa only.

As the child's condition did not warrant extensive manipulation or examination, Dr Moschcowitz was satisfied to make a hurried entero-enterostomy with a Murphy button between the nearest dilated and collapsed intestine. The patient made a satisfactory recovery from this operation. She was kept in the hospital for two months, however, because the button failed to pass, but was finally discharged on November 2, 1907.

She was re-admitted on January 5, 1908, for the purpose of removing the retained Murphy button. In the interval she had been quite well, barring an occasional attack of colic. On bimanual examination the button was distinctly felt in a loop of intestine, lying in the cul-de-sac of Douglas.

On the following day an incision four inches long was made through the right rectus, and a finger introduced into the peritoneal cavity immediately brought up without difficulty the loop containing the Murphy button, the latter being loose and freely movable in the lumen of the gut. Search was then made for the entero-anastomosis, and this was readily found. The conditions of the surrounding structures were defined with difficulty, and as near as could be ascertained, they were as follows:

The proximal portion of the intestine, that containing the button, was thick-walled and about an inch and a half in diameter, the distal portion was of normal thickness and about three-quarters of an inch in diameter. The proximal portion of the intestine had a mesentery extending up to and including the anastomosis, here it terminated in an apparently cicatrized edge. The first four inches of the distal portion of the intestine were absolutely devoid of mesentery, not even a trace of it being seen. This segment of the gut, however, was completely surrounded by and wrapped up in the thin and fat-free omentum. To accomplish this, the omentum passed through a hiatus in the mesentery in an upward and backward direction. Its exact nature was not ascertained for fear of breaking up any adhesions which might interfere with the viability of the intestine. In the mesentery, just beyond the anastomosis, there was to be seen a triangular hiatus, about four inches to a side, with its apex toward the root of the mesentery. The sides were formed, therefore, by mesentery and intestine, covered by omentum.

No difficulty was experienced in clamping off and incising

In presenting this case, Dr Moschcowitz called attention to the unusual nature of the injury found at operation, and to the transverse incision, which he had recently employed in a number of cases, and which had given him an excellent exposure and also had healed rapidly and without the formation of hernia

### ILEUS, SECONDARY TO SEPARATION OF THE SMALL INTESTINE FROM ITS MESENTERY

DR MOSCHCOWITZ presented a girl, six years of age, who was referred to him by her family physician on September 3, 1907, with the following history Eight weeks prior to that time the child was run over by a wagon, the two side wheels of which passed over her abdomen, approximately in its middle, it was not known whether the wheels passed from right to left, or *vice versa* The child was removed to a hospital and an immediate operation was advised, but this was refused by the mother and the girl was taken home

About two weeks after the injury the child was apparently perfectly well, there was no vomiting, she had a good appetite, and wished to leave the bed About that time she began to vomit and complained of pain in the abdomen This condition grew progressively worse, the vomiting became more frequent, and the bowels were constipated, although minute quantities of fæces were passed every day A condition of oliguria and great emaciation set in Almost from the beginning the mother noticed the presence of elevations and depressions upon the abdomen during the attacks of pain

On physical examination it was found that the abdomen was distended, tympanitic in the centre, with movable dulness in both flanks Approximately, about once in five minutes borborygmi were heard, and the child complained of severe pain During these attacks, peristaltic waves were distinctly outlined The main direction of these waves was perpendicular, their duration was about one minute, and they could readily be elicited by palpating the abdomen

An immediate operation was advised, and the abdomen was opened through a median incision A quantity of clear fluid escaped The colon was found collapsed, showing that the obstruction was proximal to the ileocaecal valve On being traced, a small convolute of small intestine was found, bound together by omentum and adhesions, into which terminated dilated and collapsed intestine At the apex of the dilated segment of gut

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No difficulty was experienced in clamping off and incising

In connection with this case, the speaker said, the *important question* arose, Was the good result obtained due to the *excision* and obliteration of the cyst or to the extensive *decompression*?

Dr. WILLY MEYER said that about a year ago he reported a case very similar to the one shown by Dr Moschcowitz. His patient had all the symptoms of a cerebellar tumor, but on opening the skull nothing was found, and after several aspirations, which gave no result, the wound was closed. The patient died, and at the postmortem a cavity containing at least five ounces of a clear serosanguineous fluid was found in the posterior part of the left large cerebral hemisphere, overlying the cerebellum. Were it not that indiscriminate aspiration of the brain is so often followed by severe lesions due to hemorrhage, it certainly would have been easy and possible to have struck and drained this cavity. This case had been diagnosed as one of cerebellar tumor.

The left lower extremity was much weaker than the right. The gait was uncertain, and there existed a tendency to fall forward and to the left.

An examination of the eyes made by Dr J Wolff revealed in the left eye a marked choked disk, with numerous hemorrhages, the retinal arteries being attenuated and the veins dilated. In the right eye there was a large hemorrhage covering the greater portion of the disk and masking the choked appearance, a large clot extended downward and forward from the disk into the vitreous.

Based upon these symptoms and signs a diagnosis of tumor in the right lobe of the cerebellum was made, and an extensive decompression operation decided upon. On June 17, 1911, an 8-inch curved incision was made over the occiput, with its convexity upward. The flap was retracted downward. The skull was perforated with the Hudson trephine, and most of the occipital bone, with the exception of a small tongue in the median line, was removed, including the posterior margin of the foramen magnum. The dura bulged markedly, and was incised in the form of the flap on both sides.

Dr Moschcowitz said he was just about to close the wound, being satisfied with the extensive decompression, when he decided to explore the cerebellum with an aspirator, and was surprised to find a cyst containing two ounces of clear fluid. The cyst was incised and evacuated, and the cavity then wiped out with tincture of iodine. After inserting a few strands of iodine catgut for drainage, the wound was closed.

The patient's fundi were again examined by Dr Wolff three days after the operation, and he reported that the hemorrhages were being absorbed, but that both disks were still very much choked, with no appreciable diminution of the swelling. On June 28, however, he reported a decided improvement, both disks were still somewhat blurred, but the swelling was much less than before the operation. On June 24 the patient was examined by Dr Abrahamson, and he reported improvement in every respect.

The patient left the hospital on July 1, fourteen days after the operation. He had since been kept under observation, a period of almost a year and a half, and at the present time, with the exception of a cerebral hernia and a slight halt in his speech, he was normal in every respect.



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#### DISLOCATION OF THE HEAD OF THE RADIUS COMPLICATED BY FRACTURE OF THE ULNA AND VOLKMAN'S ISCHÆMIC PARALYSIS

DR ARTHUR L. FISK presented a girl, 23 years old, who, while riding horseback on July 26, 1910, was thrown, and when she struck the ground the left arm was twisted back of her. A fracture of the ulna at the junction of the upper and middle thirds was made out, and the swelling about the elbow, which was very pronounced, was thought to be due to an effusion. On July 28 a fluoroscopic examination was made of the elbow-joint; it was pronounced to be uninjured, and an X-ray plate was taken of the fracture of the ulna only. The case was treated, therefore, as a simple fracture of the ulna.

The pain in the arm was constant and intense throughout the entire time that the splint was worn, and it was found to be impossible to flex the forearm to a right angle. On October 19, 1910, two X-ray photographs were taken of the elbow and forearm, from which it was discovered that there was a dislocation of the head of the radius forward and upward in addition to the fracture of the ulna, which had united at an angle. When Dr Fisk first saw the case, about ten days later, he found a dislocation of the head of the radius forward and upward, also an old united fracture of the ulna, with angular deformity, and a Volk-

man's ischæmic paralysis of the muscles of the forearm, wrist, and hand, so extensive that these were without function and the fingers were *en griffe*

Dr. Fisk operated on November 5, 1910, making an incision about seven inches long over the site of the fracture of the ulna on the posterior aspect of the forearm, and extending down to the bone. The ulna was re-fractured along the line of union. Then reduction of the dislocation of the radius was attempted, but found to be impossible. The incision was thereupon extended upward and outward, so as to open into the capsule of the joint, and the head of the radius was found to be outside of the anterior ligament of the joint, which had become so firmly adherent that reduction could not be effected. The anterior ligament was then incised, and the head of the radius drawn through. Even then reduction could not be accomplished because of the retraction of the muscles, which were also firmly bound up in the ischæmic paralysis, so that the head of the radius could not be brought down to the capitellum. The head of the radius was therefore excised and the ends of the ulna squared off and wired. The capsule of the joint and the wound were sutured without drainage, and the arm put up at a right angle with the hand in supination. This splint was left on for two weeks. It was then taken off, and the forearm, wrist, and hand treated with massage and electricity every day to overcome the Volkman's paralysis, which was becoming more and more aggravated. On January 16, 1911, it was still so pronounced that the hand was *en griffe* and useless. There was no rotation of the radius, and flexion and extension were very limited. Within a month, however, there was marked improvement. Extension was obtained to 150 degrees, flexion to 90 degrees, rotation of the radius to 90 degrees, and supination was complete. The fingers, with the exception of the index-finger, could be fully flexed and extended, and the thumb opposed to all. The patient was able to arrange her hair and feed herself. Since then the improvement had been continuous, and at the present time there was full extension, flexion to 95 degrees, pronation to 90 degrees, full supination and full flexion, and extension of the wrist. The inability to fully extend the index-finger, which could be done with the wrist flexed, the inability to fully flex the elbow, and the limitation of pronation to 90 degrees were the disabilities that still existed. The patient can now

play on the piano, and carry her six-months-old baby with that arm

Dr Fisk said that in all cases of either fracture of the ulna or dislocation of the head of the radius, a careful examination should be made to determine the presence or absence of the other injury. Immediate reduction of the dislocation should be attempted, if this could not be accomplished, then either an immediate or a deferred operation must be decided on. Opinions differed as to the advisability of an immediate operation; some considered it best, others thought that no operation should be performed for two or three months. Perrin held the view that an immediate operation should not be performed on patients under the age of fifteen because of the possibility of the necessity of excision of the head of the radius, which was undesirable before full growth had been attained. Ashhurst contended that reduction should not be impossible in recent cases if the operation was properly performed, and therefore that excision of the head of the radius would not be necessary. The object of operating was to remove the torn capsule from in front of the capitellum of the humerus and from over the lesser sigmoid cavity of the ulna, and to suture the capsule around the neck of the radius. Old, irreducible cases, where the ulna had united, were usually treated by excising the head of the radius.

Dr Fisk said that 140 cases of this combined injury had been recorded up to the present time. Five of these were operated on immediately, and 26 after an interval of several months.

#### UNILATERAL HYPERTROPHY OF THE ARM

Dr ROBERT T MORRIS showed a girl, nineteen years old, in whom at birth it was noticed that one arm was larger than the other. Since then it had been observed that the disparity in the size of the two upper extremities had gradually become more marked, and at the present time the right arm was about two and a half inches longer than the left and more than three inches greater in circumference, and it was still increasing in size. The enlargement apparently included the bones, soft tissues, and blood-vessels, and resembled an angiomatous condition.

Dr MOSCHCOWITZ said that while he had no suggestions to offer in regard to treatment, the condition in the case shown by Dr Morris was one that had been described more or less frequently under the name of partial gigantism "Riesenwuchs," of

which the speaker said he presented an example before the Surgical Section of the New York Academy of Medicine a few years ago. In that case, one of a man's toes was affected, and on account of its gradual increase in size he said that it kept him poor buying new shoes. An examination showed that there was an enlargement of the entire right lower extremity and of the right abdomen.

Dr Moschcowitz said that this condition was congenital, the enlargement was of an angiomatous type, and involved both the bones and soft tissues. It had nothing in common, so far as he knew, with acromegaly or disease of the pituitary body. It was always congenital, and involved particularly the venous system.

Dr GIBSON said he had seen this condition of unilateral hypertrophy limited to the great toe or to several toes.

Dr FRANK S. MATHEWS, in connection with the case shown by Dr Morris, said that about a year or two ago he saw a child who had had incisions about the shoulder in infancy for an epiphysitis. When Dr Mathews saw the case, the affected arm was an inch or so shorter than its fellow, but about twice the circumference of the normal arm. The veins were very much enlarged, and there was a loud thrill over the vessels, and he suspected that he had to deal with an arteriovenous aneurism, while the arrest of growth was probably due to an osteomyelitis of the upper humerus. On operation he could find no connection between the artery and vein. The axillary artery was exposed and was found to be about two or three times normal size.

#### STRICTURE OF THE PYLORUS, POSTERIOR GASTRO-ENTEROSTOMY

Dr BENJAMIN T. TILTON presented a woman, 48 years old, who was admitted to the hospital three months ago suffering from severe epigastric pain and vomiting. Her history of stomach trouble dated back six years. The vomiting occurred about four hours after taking food, and the pain radiated toward each side. She had lost 25 pounds in weight.

Examination of the stomach contents revealed an excessive amount of free hydrochloric acid, no blood, no Boas-Oppler bacilli. The motility of the stomach was diminished, and its lower border reached to the umbilicus. The case was regarded as one of dilated stomach due probably to a benign stricture of the pylorus.

Operation showed a distinct thickening at the pylorus, a few regional glands in the greater and lesser omentum, and a very large stomach. A posterior no-loop gastro-enterostomy was done, with clamps. The enlarged glands showed a simple hyperplasia of the glandular elements. Since the operation the patient had gained about ten pounds and had had no recurrence of her digestive symptoms.

### PYLORIC ADHESIONS

DR BENJAMIN T TILTON presented the patient, a woman 33 years old, who for ten weeks prior to her admission to the hospital had suffered from vomiting following the ingestion of food. This was accompanied by epigastric pain radiating through to the back. She had lost about 30 pounds in weight. Treatment by her physician in the form of diet and medication had produced no effect upon the vomiting, which had become so constant after eating or drinking that she practically took nothing into her stomach. It was impossible to get a gastric analysis, as the test meal was immediately vomited.

During the patient's first week in the hospital an attempt was made to overcome the vomiting but without result, and as the patient was becoming very weak, an operation was advised. Upon exposure, the stomach appeared to be of normal size, and an examination of the gall-bladder showed nothing abnormal. Thin adhesions, however, were found extending from the gall-bladder to the pylorus, which were readily divided, without hemorrhage. As there was no obstruction at the pylorus, a gastro-enterostomy did not seem indicated.

With the operation, the vomiting ceased immediately, and it had not recurred since. The patient had regained her lost weight in the two months since she left the hospital. She was able to eat practically any kind of food and felt that she was entirely well.

DR WILLY MEYER said that in operating on these cases of pyloric obstruction, the possibility of an early malignant condition should never be lost sight of. While the immediate examination of frozen sections was of value in establishing the diagnosis, he no longer placed implicit faith in the accuracy of such reports, and when he had to deal with an infiltrated and strictured pylorus which was at all suspicious of an early carcinoma, he favored a radical excision though the glands were reported

healthy He recalled one of his cases where a failure to follow this rule led to subsequent regret, and where a patient who had been assured that he had been relieved of a benign obstruction of the pylorus by means of gastro-enterostomy returned two years later with an inoperable carcinoma The speaker said he was now strongly in favor of resecting the strictured pylorus in every case, provided the patient's general condition permitted such radical work

DR MORRIS called attention to the fact that adhesions about the pylorus and gall-bladder, such as Dr Tilton encountered in his case, often showed the presence of the colon bacillus These belonged to the group that had been described by the speaker as cases of "cobwebs in the attic"

#### GIANT MUCOCELE OF THE APPENDIX, RESECTION OF CÆCUM, ILEOCOLOSTOMY

DR WILLY MEYER presented a man, 42 years old, who for the past three years had shown all the evidence, clinically, of a chronic appendicitis Examination showed a tumor formation in the region of the cæcum which was suggestive of either tubercular or malignant disease The tumor was slightly tender on pressure, and the patient also complained of pain when the bladder was filled or emptied, indicating the presence of adhesions He gave a history of having had frequent attacks of mild intestinal obstruction, with pain and vomiting

Operation, December 28, 1911 Dr Meyer made an incision alongside the rectus, coming down on a mass which was adherent to the bladder and iliac fossa After double ligation and division it was seen that this mass had the shape of the appendix, which could not be found The cæcum was much infiltrated The lower end of the ileum with cæcum and half of the ascending colon were excised and both ends closed An ileocolostomy was then done with needle and thread, making an anastomosis between the ileum and the first half of the transverse colon, as safe access to the ascending colon was impossible

The abdomen was closed, and after a stormy convalescence the patient recovered Pathologically, the specimen proved to be a giant mucocoele of the appendix, filled with gelatinous mucus The specimens were presented

DR BURTON J LEE said he recently saw a very excellent specimen of a mucocoele of the appendix, a case of Dr Kenyon's

It was not quite as large as the one shown by Dr Meyer, but very distinct, without any opening into the bowel. The specimen was examined by Dr James Ewing, and there was some question in his mind as to whether it really was a cyst of the appendix. It was filled with material similar to that found in Dr Meyer's case.

DR MATHEWS said that about ten years ago, while doing pathological work at the Woman's Hospital, he saw a specimen of this type, although not nearly so large. It was about the shape of an Indian club and was filled with material similar to this.

DR MOSCHCOWITZ recalled a case where he had operated on an appendix much smaller than the one shown by Dr Meyer, where he found that the appendix had perforated and that a large quantity of this gelatinous material had escaped, almost filling the abdominal cavity. The speaker said he thought that this material was almost of a malignant nature, and as some of it was necessarily left behind in the abdominal cavity, recurrences were to be expected.

#### RESECTION OF THE STOMACH FOR BENIGN PYLORIC STENOSIS

DR WILLY MEYER presented the patient, a man 36 years old, who was admitted to the German Hospital on May 23, 1912.

The history he gave was that about seven years ago he began to suffer from discomfort and often pain, with belching of gas, after meals. The pain was confined to the upper abdomen. These symptoms continued for about two years. Five years ago he had a sudden and severe hemorrhage from the stomach, and after recovering from the effects of this loss of blood he was free from stomach symptoms for two years. Then he again began to suffer from gastric pain, occurring two or three hours after meals, together with loss of appetite. About three weeks before coming to the hospital he began to vomit, the attacks of vomiting usually coming on two or three hours after meals. The patient stated he often vomited more than he had eaten at the previous meal, and that the vomitus at times contained food taken on the preceding day, there was no further history of hæmatemesis. He denied lues.

The patient, on admission, was emaciated and anæmic. There was no jaundice. The heart and lungs were negative. The abdomen was flat and tense, no tenderness, no abnormal masses could

he felt. Upon lavage of the stomach, fully a quart of fluid containing undigested food, large particles of bread, etc., was evacuated, and after ten pints of fluid were introduced, the washings failed to return clear.

The case was regarded as one of pyloric stenosis, probably benign, and on June 6, 1912, Dr Meyer exposed the stomach through a median incision, coming down upon a hard, nodular mass at the end of the first portion of the duodenum, and firmly adherent to the head of the pancreas. Owing to the inaccessibility of this mass, a transverse incision was made across the right rectus. The tumor mass was then freed from the surrounding structures. Now Huell's surgical wire stitching instrument (large clamp) was placed at the gastric side of the mass, and a similar smaller clamp placed distally, i.e., on the jejunal side. The metal staples in the stomach held well, but a few of the duodenal stump tore through, when the latter was handled. A continuous silk suture inverted the stump in the stomach and a double one that of the duodenum.

An opening was then made in the mesocolon, a portion of the stomach rest drawn through this orifice the stomach united to the margin of the wound in the mesocolon, and a posterior gastro-enterostomy made between it and the duodenum with the button. There was hardly space on the stomach side to insert the button. The wound was then closed and the patient made an uninterrupted recovery. The pathologist (Dr James Ewing) reported that the structure was of benign character.

The speaker said that he was much indebted for the exhaustive report on the specimen by Dr Ewing, who had volunteered to examine all specimens of pyloric resection for the surgeons, who had joined the committee for a collective investigation of ulcer of the stomach, that had recently been formed here in conjunction with the original one in Germany. In this case it seemed that a primary disease of the arterial walls had caused the development of the ulcer.

Dr MEYER, in reply to a question, said that while the wire-stitching instrument, which he had used in this case, and which he had demonstrated at one of the previous meetings of the Society, saved a certain amount of time, its chief advantages were that it left the line of suture absolutely dry and aseptic. In stomach surgery its employment was not of much importance, but in suture work about the cæcum or colon where the patients



were much reduced, its simplicity and the dry, aseptic suture line it gave might well be of value. Objections to the use of the instrument were that it was expensive, the cleaning and recharging somewhat complicated, and that any damage to it could probably not be repaired on this side of the Atlantic. He emphasized that he favored the use of needle and thread in our daily routine work on stomach and intestines.

#### DIFFUSE DILATATION OF THE THORACIC AORTA, EXPLORATORY THORACOTOMY

DR WILLY MEYER presented a man, 43 years old, who was admitted to the German Hospital on May 15, 1912. He gave a history of gonorrhœa and chancre over 20 years ago, and pneumonia four years ago. His wife had had eight children, four of whom were alive and well, three had died at birth from convulsions. No miscarriages.

About a year ago the patient began to have pain in the upper portion of the left abdomen and the lower left chest. This gradually became more severe, so that he had to give up his work about four months ago. It was worse after eating. There was no history of vomiting. For several months he had suffered from cough, with free expectoration. His sputum had been examined by the Department of Health on four different occasions, with negative results. There was no history of night sweats, no blood. The patient complained of some difficulty in swallowing, he occasionally belched gas and had sour eructations. He was constipated and had lost about 25 pounds in weight since January.

Upon admission, the patient was found to be poorly nourished. There was dilatation of the veins on the left side of the neck. The man's breathing was chiefly abdominal in character, and even on deep inspiration the chest moved but slightly. There was no asymmetry nor deformity of the chest. The breathing was vesicular in quality, and the sounds were markedly diminished over the entire left chest, both anteriorly and posteriorly. There was no alteration in the voice sounds. The cardiac dullness extended one inch to the left of the left midclavicular line, in the fifth interspace. There was a diffuse precordial pulsation seen and felt, but no definite apex impulse. There was a soft, blowing systolic murmur heard in the mitral area and in the second left interspace, not transmitted to the neck. There was an occasional intermittence, otherwise the heart sounds were

regular in force and rhythm. The chest was barrel-shaped, the lips and finger-nail beds slightly cyanotic. The abdomen showed nothing abnormal. The radial pulse was somewhat weaker on left side, but regular, there was increased tension, no radial thickening. X-ray examination showed a shadow in the left part of the chest, corresponding to a diffuse dilatation of the entire thoracic aorta. In view of the missing typical clinical symptoms an intrathoracic tumor could not be excluded.

Operation, June 20, 1912. Exploratory thoracotomy under differential pressure. An incision, eight inches long, was made between the seventh and eighth ribs, commencing near the spinal column. After dividing the muscular tissue down to the pleura, the lung could be seen, freely movable, through the pleura. After incision of the pleura and upon drawing the two ribs apart and pushing the lung to one side, a diffuse dilatation of the thoracic aorta was seen. The dilatation reached downward to about one inch above the diaphragm. The lung was adherent to the aneurism and riding on it anteriorly in the upper portion of the pleural cavity. The thorax was then closed in typical fashion. Patient made an uninterrupted recovery. He was out of bed on the fifth day after the operation with primary union of the thoracotomy wound. To-day patient claims to be stronger and better than before the operation.

Dr. WILLIAM C. Lusk said that he had performed the Moore-Corradi operation on at least two cases of fusiform aneurism of the aortic arch with resulting relief to the distressing symptoms, the X-rays of the results demonstrating the loops of wire lying just within the limits of the aneurismal shadows. The technic which he employed was to use the No. 29 size of the resilient gold platinum silver copper "clasp" alloy wire, shaped in loops of a diameter greater than that of the X-ray shadow of the aneurism, the entering extremity of the wire being spiroform, which he introduced through the insulated gold needle into the aneurismal cavity after the manner of uncoiling a rope, by which manoeuvre twists were carried in with the wire as it was fed in, causing the loops to re-form within the aneurism, which, from their large size, expanded to the limit allowed by the confines of the aneurism, thus taking a peripheral arrangement within the sac. The wire was in this way so placed that the electrical current passing through it could traumatize the intima. A current of 100 milliamperes, 50 milliamperes, 40 milliamperes, 30 milliamperes, each for 15 minutes, was passed, which in the case of wiring a dog's

aorta would both traumatize the intima at the sites of contact of the wire and cause a deposit of fibrin along the wire, which at the sites of trauma would become adherent during the passage of the electrical current, and, subsequently undergoing organization, would produce thickenings in the arterial wall. Laminated fibrin in aneurisms seemed to be laid down only in those localities where the blood stream was sufficiently slowed. No complications had supervened as a result of using this technic.

#### A SIMPLE APPARATUS FOR INSUFFLATION ANÆSTHESIA

DR JOHN ROGERS demonstrated this apparatus, which consisted of an ordinary foot bellows and tube to which was attached a Y glass tube with one arm of the Y leading into a six-ounce bottle containing sterilized cotton for filtering the air, and thence an arm of another Y tube and so to the silk elastic catheter introduction into the trachea. A —| tube carrying a "Ty-  
" sphygmomanometer was joined to the proximal end of the catheter to show the air pressure. The opposite arm of the first Y tube leads to another six ounce filter bottle, containing sterilized cotton, and from this into and out of the top of another similar sized bottle containing ether and thence through a third empty bottle to catch any condensation of the vapor and from the third bottle into the unoccupied arm of the second Y tube, and so to the tracheal catheter. A stop cock on each arm of the first Y tube regulates the amount of air which thus passes in two directions, No 1 through the bottle containing only cotton and No 2 through a series of three bottles, one of which supplies the ether vapor. Experience with three cases of operations upon structures causing difficulty with respiration after preliminary trial on animals showed that this "home made" and inexpensive apparatus is very satisfactory. The Tycos sphygmomanometer could be replaced by any other of the common instruments for measuring blood-pressure. It is only with difficulty that the air pressure can be raised above the 20 mm of mercury which is known to be the safe limit. Dr Rogers introduces the catheter through the larynx by touch alone like an intubation tube. The four bottles, one of which carries filtered air only and the other three filtered ether vapor, are immersed when in use in a basin of water at 105° F. The two stop cocks are left open so that an equal amount of pure warmed air and of pure warmed air carrying ether vapor enters the patient's trachea.

*Stated Meeting, Held at the New York Academy of Medicine,  
November 27, 1912*

The President, DR CHARLES L GIBSON, in the Chair

#### EXTENSIVE OSTEOMYELITIS

DR HOWARD D COLLINS presented a girl, twelve years old, who was admitted to the hospital on June 11, 1911, with the history that for three days she had suffered from a high fever, with pain in the right forearm and right thigh. On admission, the right thigh was tender, and the right wrist presented the appearance of an acute articular rheumatism. On the following day there was a small point of fluctuation on the dorsal surface of the wrist. An incision showed an infiltration of pus throughout the muscle planes of the forearm, with a tiny perforation through the periosteum at the lower end of the radius, from which pus was oozing. Upon incising the periosteum, the entire radius was found to be destroyed subperiosteally. A month later an incision was made over the right thigh and necrosed bone found in the lower part of the femur, with staphylococcus infection. The patient's convalescence was very protracted, and during the 18 months that she remained in the hospital many secondary operations were necessary. She finally recovered entirely, and the X-ray plates showed regeneration of bone in various stages of formation in the radial periosteum.

DR CHARLES N DOWD said he could recall several cases of very extensive osteomyelitis in which subsequent regrowth of the bone took place. The epiphysis is usually preserved. In the case shown by Dr Collins, he did not feel at all convinced that the epiphysis had been destroyed and hence would not be surprised to see a re-formation of the bone. The speaker said he was in favor of leaving a longitudinal section of the bone in these cases, as Dr Collins had done, rather than to remove the entire shaft, as had been advocated by some. Such a strip of bone gives a support to the limb, and preserves the shape of the bone, the radiograms indicate well-formed new bone at the end of a year, and it takes as long as this when the entire shaft has been removed.

#### COMPOSITE ODONTOME

DR FRANK S MATHEWS presented a boy, eleven years old, upon whom he had operated two years ago for a tumor of the mandible, near the angle. An incision was made into the gum

over the tumor, through which the latter was removed with ease. It was a stony hard growth, lying practically free in the jaw in a cavity formed by the thinning out of the bone around the tumor and displacing the normal tooth follicles. The tumor (Fig 1) was covered by a thin membrane which was reflected from the base of the growth and lined the jaw cavity, at the bottom of which the inferior dental nerve lay exposed.

The epithelial elements of the tooth follicles, Dr Mathews said, might give rise to (a) dentigerous cysts, (b) benign multicystic tumors, and (c) adamantinomata, which were locally destructive but otherwise of low grade malignancy, since they rarely gave rise to metastases. The dentine organ could also form the origin of tumors. In the growth presented, all the tooth elements were present, hence, it was a compound odontome. The mass of tumor was composed of dentine.

#### MYELOMA OR GIANT-CELLED TUMOR OF THE TIBIA

DR MATHEWS presented a young woman, 24 years old, who was admitted to the St Francis Hospital in September, 1911. She had had pain in the left knee for six months. This had pronounced a tuberculosis of the knee at one of the hospitals in this city, and a resection had been urged. The limb had been in a plaster splint for some months.

Examination showed an unusually healthy appearing girl—an unlikely subject for tuberculosis. From immobilization of the limb the thigh and leg muscles had become atrophied, but the knee measurements were the same on both sides. There was stiffness of the knee, but no spasm, and the joint contained no fluid. The Von Pirquet test was negative. The X-ray (Fig 2) showed a light area in the outer tuberosity of the tibia, but the lateral view showed that this area was half an inch from the anterior surface of the bone. The growth had nowhere expanded the bone.

The location of the disease as well as the X-ray appearances suggested the diagnosis of a myeloma or giant-celled tumor, usually called sarcoma. At operation, a longitudinal incision was made over the tuberosity, and after cutting away a half inch of normal bone the tumor was reached. An Esmarch bandage had been applied, so that the macroscopic character of the tumor could be carefully studied. With the curette, a mass of granulation-like, plum-colored material was removed.

from the cavity whose dimensions were an inch by an inch and a half. The joint cavity was invaded for a circular area about three-fourths of an inch in diameter. The walls of the cavity were vigorously scraped and then swabbed with a strong bichloride solution. An effort was made to diminish the size of the cavity by cutting away its bony margins and forcing the periosteum deeper down, after the Neuber method, and the wound was then packed with sterile gauze.

Great care was taken to preserve asepsis, because of the open communication with the knee-joint. Synovial fluid drained out for some weeks. The wound remained clean and soon healed down to a small sinus, which required a year to close. The patient now had a useful limb as far as bearing her weight was concerned, but the knee was stiff. There was no suggestion of recurrence.

DR MATHEWS said the lesion in this case was a vascular and cellular tumor composed of round- and polyhedral-cells, with occasional giant-cells, although the latter were much less conspicuous than in the usual giant-celled central tumor of bone. The cellular character and the scarcity of giant-cells might make one fear that the tumor was less benign than the typical giant-celled tumors. In another case reported by the speaker ("Myeloma of the Long Bones," *ANNALS OF SURGERY*, Sept., 1910), which was treated by curettage, a microphotograph of the tumor was shown in which giant-cells were very scarce, yet the patient had remained well for nine years. In the case shown at this meeting 15 months had elapsed since the operation, and Dr Mathews said he had little doubt that a permanent cure had been effected. He had long felt that these tumors should not be called sarcomata, because they were benign. Bloodgood had suggested the name giant-celled tumor. The speaker's only objection to this name was based on his experience in the two cases mentioned, where tumors which seemed clinically to belong to this group had been conspicuously poor in giant-cells. In his paper on the subject above mentioned, he had followed Sutton and Adams in calling them "myelomas," a term that could be criticized because it suggested an origin in marrow cells, whereas it was more likely that they were produced by the osteogenetic elements of bone. Their foreign character and the wisdom of conservative treatment in dealing with them had been quite strongly evidenced in recent years.

in infants, but not the exception. He also observes that during his work of collecting some 225 cases of strangulated herniæ of all kinds, under two years of age, he found that in nine of the largest clinics in Europe the records showed not a single case operated upon. He further estimates the relative frequency of strangulation in children to that in adults as 1:62. Frickhoffer<sup>22</sup> estimates it as 1:107; Stern as 1:108.

One hundred and twenty, or one-half of Estor's cases, occurred within the first six months. (This, of course, includes umbilical and femoral herniæ.) In ten cases no hernia had been noticed up to the time of strangulation.

Broca<sup>7</sup> states that strangulation under one year is more common than later.

Moynihan's tables<sup>14</sup>—quoted by Carmichael—show strangulation to be most common during the first month of life and gradually less frequent up to one year.

It is probably true that there has been a tendency to underestimate rather than to overestimate the number of cases calling for operation.<sup>24</sup> McLaurin suggests as an explanation of the relative rarity of these cases the softness of the structures at the neck of the sac, making the pinching down upon the gut in an existing hernia an unusual occurrence. Estor, also, states that the rarity of the accident of strangulation is perhaps explainable by the feeble resistance of the tissues which form the sac of the hernia.

Coley,<sup>26</sup> on the other hand, saw but one case in which he believed the strangulation was due to the neck of the sac. In all other cases he explained the strangulation by tightness at the external ring. He thinks the neck of the sac is not the cause of the constriction.

Broca observes that children, up to one year or 18 months, with backward physical development, present conditions predisposing to hernia.<sup>7</sup> He gives as the predisposing causes rachitis, malformations of the peritoneum, and prematurity. Paternal heredity seems to be a notable factor. Many children are born with a hernia already formed and frequently containing a portion of the large intestine. Moreover, ill-nourished children show no tendency to spontaneous cure, but the condition is more and more aggravated by crying and straining, bringing about, as it were, a vicious circle of ill-nourishment, fretfulness, and aggravation of such herniæ as may exist.

It is quite noticeable that we find very little mention of adherent or incarcerated herniæ in infants. This is probably explained by the fact that the hernia has not existed sufficiently long to become adherent in its abnormal situation. E. Cordier, however, cites a case of double inguinal irreducible hernia found in a child at term.<sup>27</sup> Herr (Wetzlar) reports a case of incarcerated inguinal hernia in a child three months old, and mentions two cases operated by Klaussner (Munich), one at six weeks and one at four months.<sup>28</sup> It is interesting to note that in 10 or 15 cases of Kovacs's, in which he had operated in later childhood for sudden recurrence of hernia treated by truss and supposed to be cured, he found evidences of incarceration in over one-half of the cases.<sup>29</sup>

from the cavity whose dimensions were an inch by an inch and a half. The joint cavity was invaded for a circular area about three-fourths of an inch in diameter. The walls of the cavity were vigorously scraped and then swabbed with a strong bichloride solution. An effort was made to diminish the size of the cavity by cutting away its bony margins and forcing the periosteum deeper down, after the Neuber method, and the wound was then packed with sterile gauze.

Great care was taken to preserve asepsis, because of the open communication with the knee-joint. Synovial fluid drained out for some weeks. The wound remained clean and soon healed down to a small sinus, which required a year to close. The patient now had a useful limb as far as bearing her weight was concerned, but the knee was stiff. There was no suggestion of recurrence.

DR MATHEWS said the lesion in this case was a vascular and cellular tumor composed of round- and polyhedral-cells, with occasional giant-cells, although the latter were much less conspicuous than in the usual giant-celled central tumor of bone. The cellular character and the scarcity of giant-cells might make one fear that the tumor was less benign than the typical giant-celled tumors. In another case reported by the speaker ("Myeloma of the Long Bones," *ANNALS OF SURGERY*, Sept., 1910), which was treated by curettage, a microphotograph of the tumor was shown in which giant-cells were very scarce, yet the patient had remained well for nine years. In the case shown at this meeting 15 months had elapsed since the operation, and Dr Mathews said he had little doubt that a permanent cure had been effected. He had long felt that these tumors should not be called sarcomata, because they were benign. Bloodgood had suggested the name giant-celled tumor. The speaker's only objection to this name was based on his experience in the two cases mentioned, where tumors which seemed clinically to belong to this group had been conspicuously poor in giant-cells. In his paper on the subject above mentioned, he had followed Sutton and Adams in calling them "myelomas," a term that could be criticized because it suggested an origin in marrow cells, whereas it was more likely that they were produced by the osteogenetic elements of bone. Their foreign character and the wisdom of conservative treatment in dealing with them had been quite strongly evidenced in recent years.



as illustrating a perfect result obtained by a very simple method—reduction by downward traction and securing the upper arm to the body by two straps of adhesive plaster, one at the elbow and the other midway from elbow to shoulder. At this time, two months after the injury, the two shoulders are the same in appearance and the child has perfect use of the injured arm.

#### FRACTURE OF THE SURGICAL NECK OF THE HUMERUS IN A CHILD OPEN OPERATION

DR DOWNES presented a child, four years old, who on June 1, 1912, fell a distance of ten feet into an areaway, injuring the left shoulder. Five days later, when the child was admitted to St. Francis' Hospital, an examination disclosed a fracture through the surgical neck of the left humerus (Fig 5). Efforts to reduce and hold the fracture failed, and two days after admission the child developed a tonsillitis and bronchopneumonia which prevented further efforts at reduction until June 25. On that date, under anæsthesia, an unsuccessful attempt was again made to reduce the fracture. An open operation was then done and an oblique fracture found, and in order to maintain reduction a nail was driven in the line of the head and shaft through the coraco-acromial ligament (Fig 6). Dressing was applied with arm abducted 45 degrees. When the nail was removed, three weeks later, the fragments had firmly united. Now the child has normal motion in the joint in every direction, with the exception of very slight limitation when extreme elevation is attempted.

#### TORTICOLLIS, ILLUSTRATING TREATMENT

DR ROYAL WHITMAN presented a girl, 17 years of age, who had been treated for severe torticollis. Dr. Whitman said the essentials of the treatment were complete division of the contracted tissues, forcible stretching, and fixation in a plaster support in the over-corrected attitude for several weeks, followed, if possible, by methodical stretching and gymnastic exercises. The failure of the primary over-correction and of the after-treatment were the chief causes of unsatisfactory results.

DR CHARLES L. GIBSON said it would be interesting to note the final outcome of this case. Any form of treatment usually was followed by immediate improvement, but recurrences were the rule. Personally, he was inclined to believe that complete excision of the sternomastoid was indicated in very aggravated cases.

FIG 5



Fracture of the surgical neck of the humerus

FIG 6



Fracture shown in Fig 5 with nail driven through canal in order to maintain fragments in position



DR WHITMAN, in reply to the statement of Dr. Gibson that a recent case was not convincing, said, that a deformity of long standing could not be cured by any operation. Division of the contracted tissues enabled one to over-correct the deformity. This over-correction should be retained for a sufficient time and should be supplemented, if possible, by methodical stretching and by exercises, for unless the deformity habit were overcome, recurrence in some degree at least might be anticipated.

The Mikulicz operation represented apparently another point of view, namely, that torticollis might be cured by an operation, if it were sufficiently radical. As the muscle was but one of the factors of deformity, its removal was, he thought, illogical, and it had the further disadvantage of leaving an unsightly scar.

DR F KAMMERER said that in a very aggravated case of torticollis in an adult which he had observed last winter, simple division and appropriate after-treatment had been followed by a return of the contraction in three or four weeks. He then made a very complete extirpation of the sternomastoid muscle and the surrounding cicatricial tissue, which ultimately gave a much better result than mere division. The speaker was willing to admit that careful mechanical treatment after operation might improve the result after simple division.

#### REMOVAL OF THE SEMILUNAR CARTILAGES FROM BOTH KNEES

DR WHITMAN presented a woman, 22 years of age, from whom he had recently removed the internal semilunar cartilage from both knees for the relief of discomfort and disability of several years' duration. The speaker said he favored early operation in these cases, as a displaced cartilage was of no service, and rather a source of injury to the joint.

#### CHRONIC BILATERAL FIBROID BURSITIS

DR W S SCHLEY presented a mulatto, 38 years old, who had a firm, somewhat lobulated, movable tumor, at present one and three-quarters by one and a half by one inch in dimensions, on either forearm, just *below* the olecranon. These tumors were first noticed about four and a half years ago. They were absolutely symmetrical as regarded position, size and touch. Their growth had been gradual over a period of three and a half years, and the patient stated that during the past year they

had not increased in size. Prior to the development of these tumors the patient had worked as a sand-hog in caisson excavation, which necessitated awkward positions in which the elbows and forearms usually bore the brunt of the pressure. At times there was soreness over the olecranon and upper ulna, but this was never sufficiently severe to cause him to stop work. He gave no history of a simple bursitis or hygroma at the time that he was working. These tumors were below the true olecranon bursæ and were situated in the subcutaneous tissue over the upper part of the ulna. The possibilities seemed to be that they were fibrous tumors from connective-tissue irritation or fibroid changes in bursæ.

Actual tumor formation in bursæ was of rare occurrence, the more common form of bursal trouble, chronic bursitis, leading to thickening or even calcification of the sac, with occasionally spontaneous hemorrhages with organized fibrin contents, etc. As regarded new growths, Delfino, in 1905, found but 31 cases in the literature, chiefly myxoma and sarcoma. Duret actually found five bursæ in one person simultaneously the seat of endothelioma. In the case he had shown, Dr Schley said, we probably had a true fibrous new growth. The patient gave a syphilitic history, but the tumors were in no way characteristic of that infection.

#### BLOOD INJECTION FOR UNUNITED FRACTURE

Dr H H M LYLE presented a young man, who was admitted to St Luke's Hospital seventeen and a half weeks ago with a fracture of the tibia and fibula of the right leg. The fractures, which were at the junction of the middle and lower thirds, were treated in the routine manner, the fragments being placed in good position, as shown by the X-ray. Three and a half months later there was no attempt at union, and the X-ray showed a typical pseudo-arthritis. Bier's injections of blood were given, and at the completion of the eighth injection there was firm ankylosis. The nature of this union was clearly shown by the X-ray. Twenty to thirty cubic centimetres of the patient's blood were taken from the median basilic vein and injected between and around the bones. These injections were given every six days and signs of commencing union were apparent after the third injection.

Dr Lyle said he had found it difficult to carry out the

technic as described by Bier, on account of the rapidity with which the blood clotted. This called for very rapid work, which in turn interfered with the thoroughness of the procedure. To overcome this drawback he drew up some warm sterile albolene through the needle into the syringe and then expressed it, leaving a fine film of albolene covering the needle and syringe. This film prevented the clotting in the syringe and needle, and allowed a careful, accurate, and thorough injection of the blood around and between the fractured ends. He considered this small detail a great aid in carrying out this valuable method of treatment.

#### THE WIRING OF THORACIC ANEURISM

DR WILLIAM C LUSK read a paper with the above title. In connection with his paper, Dr Lusk showed four patients who had been successfully treated by this method. Also two specimens, showing the wired thoracic aneurism. He also showed a number of radiographic illustrations.

DR WILLY MEYER said it was evident that surgery had made a great step forward in the treatment of these practically hopeless cases of thoracic aneurism by the Moore-Corradi method, and its development by Dr Lusk. The speaker said that some twenty-five years ago he had seen Dr F Lange at the German Hospital wire an aneurism of the descending abdominal aorta, with very little resulting improvement in the patient's condition. That operation was done in a more or less experimental way. Since then the procedure had been placed on a more scientific basis, and we now knew that it was not only the wiring but the subsequent electrolysis that produced the beneficial effects. He recalled the case of a physician who was not long ago operated on by this method at the Johns Hopkins Hospital, and who was so much improved thereby that he had since been able to resume his practice. The splendid results in the cases presented by Dr Lusk spoke for themselves.

Dr Meyer said that recently, at the German Hospital, he operated on a patient who was suffering from what seemed to be a fusiform aneurism of the ascending aorta. The man was a hopeless invalid, suffering great pain, and at times expectorating blood. Dr Lusk was present at the operation, and the technic he had described was carried out minutely. After properly coiling the wiring, previous to the operation, so that it could be readily uncoiled—and this required a great deal of

over the tumor, through which the latter was removed with ease. It was a stony hard growth, lying practically free in the jaw in a cavity formed by the thinning out of the bone around the tumor and displacing the normal tooth follicles. The tumor (Fig 1) was covered by a thin membrane which was reflected from the base of the growth and lined the jaw cavity, at the bottom of which the inferior dental nerve lay exposed.

The epithelial elements of the tooth follicles, Dr Mathews said, might give rise to (a) dentigerous cysts, (b) benign multicystic tumors, and (c) adamantinomata, which were locally destructive but otherwise of low grade malignancy, since they rarely gave rise to metastases. The dentine organ could also form the origin of tumors. In the growth presented, all the tooth elements were present, hence, it was a compound odontome. The mass of tumor was composed of dentine.

#### MYELOMA OR GIANT-CELLED TUMOR OF THE TIBIA

DR. MATHEWS presented a young woman, 24 years old, who was admitted to the St. Francis Hospital in September, 1911. She had had pain in the left knee for six months. This had been pronounced a tuberculosis of the knee at one of the hospitals in this city, and a resection had been urged. The limb had been in a plaster splint for some months.

Examination showed an unusually healthy appearing girl—an unlikely subject for tuberculosis. From immobilization of the limb the thigh and leg muscles had become atrophied, but the knee measurements were the same on both sides. There was stiffness of the knee, but no spasm, and the joint contained no fluid. The Von Pirquet test was negative. The X-ray (Fig 2) showed a light area in the outer tuberosity of the tibia, but the lateral view showed that this area was half an inch from the anterior surface of the bone. The growth had nowhere expanded the bone.

The location of the disease as well as the X-ray appearances suggested the diagnosis of a myeloma or giant-celled tumor, usually called sarcoma. At operation, a longitudinal incision was made over the tuberosity, and after cutting away a half inch of normal bone the tumor was reached. An Esmarch bandage had been applied, so that the macroscopic character of the tumor could be carefully studied. With the curette, a mass of granulation-like, plum-colored material was removed.

sacrificed the several feet of normal intestine between the two ruptured areas, some time would have been saved, as it would have necessitated but a single resection, and the man might possibly have survived. Time might also have been saved by leaving the injured intestine outside of the abdomen, merely clamping the ruptured portions of the mesentery, and at a later date doing the necessary resection.

## INTERMITTENT HOUR-GLASS STOMACH

DR H. H. M. LYLE reported this case and showed a number of radiographic plates illustrating the same. The patient was a woman, 31 years old, who entered St. Luke's Hospital on September 15, 1912. For seven years she had suffered from indigestion and pain in the left side and back, and during the past four and a half years she had vomited every morning. This latter symptom was considered by a gynecologist whom she had consulted as reflex in character, due to an adherent retroverted uterus. An operative correction of the displacement was advised and carried out, but no symptomatic relief was obtained. On the contrary, the vomiting had grown steadily worse.

On entering the hospital, the patient's condition was so pitiful that she was put to bed and kept under close observation for a week. The striking feature was the vomiting, this occurred every morning before breakfast, sometimes only once, sometimes several times. The vomitus was watery, meagre in amount, and contained neither blood nor food particles. Preceding or during the attacks she complained of a painful sensation of constriction in her stomach.

On examination, the abdomen showed an old laparotomy scar extending three and a half inches above the pubes. The abdomen was tender to the left of the mid-line, about one inch above the umbilicus. Dilatation of the stomach and colon gave negative results. A vaginal examination showed that the uterus was in good position. The blood count was normal, the Wassermann and tuberculin reactions were negative. No blood was found in the stools. An analysis of the stomach contents showed a slight increase in the total acidity, and it was noted that a portion of the test meal could not be recovered, although in one test performed late in the afternoon, practically the whole amount of the fluid was recovered.

A series of X-ray pictures of the abdomen were taken,



patience and labor—the needle was introduced into the aneurismal sac under local anæsthesia, and then 31 feet of the wire was fed into the sac without any difficulty and without the least resistance. Through this the electric current, carefully regulated, was then passed. Since the operation, the patient was apparently greatly improved. He had less pain, he slept better, and he suffered less from cough.

#### MULTIPLE RUPTURE OF THE SMALL INTESTINE AND MESENTERY

DR BURTON J LEE presented a specimen, the history of which was that a man who was working in a marble-yard was felled by a slab of stone which fell from overhead, striking him on the head and knocking him down. While in a prostrate position, several other slabs of marble fell on his body and crushed him. He was immediately brought to Bellevue Hospital by ambulance and admitted to the service of Dr John A Hartwell. Examination showed a scalp wound over the right eyebrow, no fracture of the skull. He was very pallid and dyspnoeic. The organs of the chest were apparently uninjured. The abdomen moved only very slightly on inspiration, and showed some ecchymosis in the umbilical region. It was rather rigid on both sides, and exquisitely tender. No masses nor movable dulness could be made out. There was a compound fracture of the neck of the left radius, with slight venous oozing from a wound over the fracture. The pulse was somewhat irregular and of poor quality.

The case was regarded as one of probable rupture of the intestine, with internal bleeding, and in spite of the man's desperate condition an operation was deemed imperative, and this was done by Dr Lee about 45 minutes after the receipt of the injury. A saline infusion, with adrenalin, was given during the course of the operation. The peritoneal cavity was found filled with fluid blood. Upon exploration, a rupture of the small intestine was found near the cæcal junction, then, after several feet of normal gut, three other intestinal ruptures and two large rents in the mesentery were encountered. Two resections, with end-to-end sutures, were rapidly completed and the rents in the mesentery closed. The operation occupied 55 minutes, and the patient died just as the abdominal wound was being closed. In connection with this specimen, Dr Lee said that had he

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting held October 7, 1912*

DR GWILYM G DAVIS, President, in the Chair

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### SPRAIN-FRACTURES

DR PENN G SKILLERN, JR, presented skiagraphs of cases of sprain-fracture as follows

CASE I—*Sprain-fracture of coracoid process of scapula.* A football player, aged 20, fell upon his right shoulder, causing luxation at acromioclavicular joint. Skiagram (Fig 1) showed a scale of bone torn off from the coracoid, probably from traction upon the coracoclavicular ligaments. Fractures of the coracoid process are rare, their line usually involving the base. The frequency of combination of this sprain-fracture with luxation at this point has not been established.

CASE II—*Sprain-fracture of wrist.* This skiagram (Fig 2) of an ordinary "sprained wrist" showed avulsion of a scale of bone from the dorsum of the carpus, probably from the os magnum. This scale was not palpable on account of the swelling, but there was distinct localized tenderness over it. A skiagram should be made of every "sprained wrist" and the treatment should be immobilization.

CASE III—*Sprain-fracture of anterior superior spine of ilium.* Male, aged 16, during a foot race felt something snap in upper part of left thigh, but finished race (five yards). Pain aggravated by flexion of thigh. Skiagram (Fig 3) showed avulsion of a shell of bone from the anterior superior spine and its immediate vicinity, evidently from action of the sartorius muscle.

CASE IV—*Sprain-fracture of cuboid.* S K male, aged 23. Twisted left foot inward and heard something crack, immediately after which swelling appeared at external tarsometatarsal joint. No previous injury here. Examination showed swelling and ecchymosis between external malleolus and this joint, and defi-

nitely localized tenderness at antero-external corner of cuboid, suggesting sprain-fracture of same. Skiagram (Fig 4) showed chipping off of a sliver of bone from antero-external corner of cuboid, evidently from overstretching of the dorsal tarsometatarsal ligament at this site. Foot strapped in over-abduction with relief of pain.

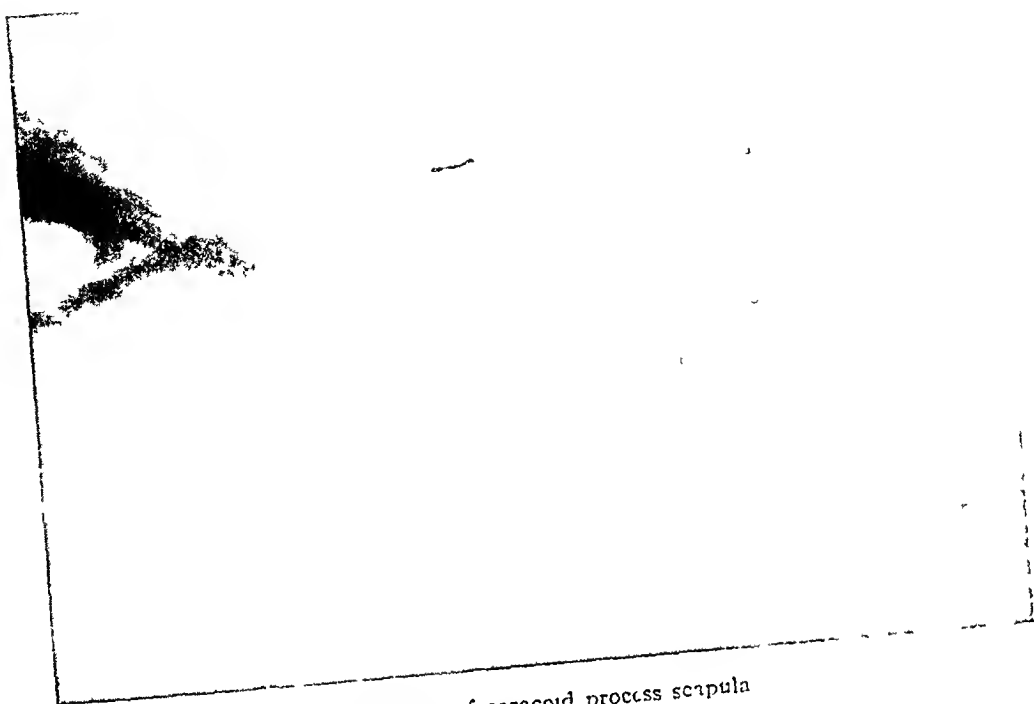
CASE V—*Fracture of adductor tubercle of femur*. Boiler-maker, aged 20, received a blow upon the lower part of the left thigh. There was localized tenderness just above internal condyle. Skiagram (Fig 5) showed separation of adductor tubercle, and the tendon of the adductor magnus leads to it as a shadow.

CASE VI—*Fracture of sustentaculum tali*. Male, aged 35, fell from a height of 10 feet, landing on feet. Skiagram (Fig 6) showed an impaction of the sustentaculum into the body of the os calcis.

CASE VII—*Fracture of clavicle, sternal end*. Male, aged 40, was struck by a heavy object upon the right clavicle. Examination revealed a dense and tender swelling over the clavicle near the sternum, which to inspection resembled a neoplasm and a luxation at the sternoclavicular joint. Skiagram (Fig 7) revealed a line of fracture within an inch of the sternoclavicular joint. In the literature this fracture is very infrequently met with.

CASE VIII—*Syphilis hereditaria tarda of femur*. Male, aged 22, farmer. Except for lesion in left thigh is robust and healthy. Three years previous to admission had what was diagnosed and treated as a fracture of the femur. For several years before that had had trouble with left femur, giving rise to a perceptible limp. Examination revealed marked bowing of left thigh, the point of greatest convexity being 13 cm below the anterior superior iliac spine. Left thigh 6.5 cm shorter than right. On palpation the upper part of the femur was of great uniform diameter, markedly roughened, but not tender. No inflammatory manifestations, no areas of softening, no sinuses. There was no history of tuberculosis, malignancy, or syphilis in the family. Diagnosis of late hereditary syphilis of femur made. Skiagram (Fig 8) revealed marked increase in diameter of upper half of femur, obliteration of medullary cavity, alternating areas of osteoporosis and osteosclerosis; and the line of an incomplete fracture at the point of greatest convexity of the femur. Wassermann reaction positive (1:1). Mercury and iodide treatment

FIG 1



Fracture of coracoid process scapula

FIG 2



Sprain Fracture of wrist

FIG. 3



S I of spine of thorn

was instituted and an orthopædic splint adjusted by Dr Willard so as to transfer weight supported by left lower limb from ground to pelvis as a base of support. After 8 months, while the patient had better use of and less inconvenience with the limb, yet skiagrams indicated but little change in the condition of the bone.

DR A P C ASHHURST remarked that an method of reducing dislocations might be classified, either as *direct* or *indirect*. Dr Thomas advocates one of the direct methods, it is the same as Stimson's or Sir Astley Cooper's, only it is applied differently. Stimson puts the patient in a sort of sling and lets the arm hang through a hole in this sling, attaching a weight to the hand. Cooper pulled the arm away from the chest, using the foot for counter-pressure. When the head of the humerus is brought away from the side of the chest and opposite the glenoid process of the scapula, then it is pushed or pulled into the socket, either by manual pressure as in Stimson's and Thomas's methods, or by leverage over the foot, as in Astley Cooper's method. All of these are direct methods, similar in principle to Allis's method for reduction of dislocations of the hip. In this sense there was nothing new in Dr Thomas's application of this principle to the shoulder. Henry H. Smith's, Kocher's, and other methods of the kind are so-called indirect methods, like Bigelow's.

It was interesting, Dr Ashhurst thought, to recall that anaesthesia not only made reduction much easier, but that it demon-

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DR ASTLEY P C ASHHURST said that it seemed to him that there was no need to exaggerate the frequency of sprain-fractures when it was possible to explain the lesions in other ways. Drs Ross and Stewart (ANNALS OF SURGERY, 1912, II, 599, Fig 4) included in their series of sprain fractures an experimental fracture of the coronoid process of the ulna which was quite clearly caused by direct violence and not by ligamentous distraction. So in the case reported by Dr Skillern, it seemed to Dr Ashhurst that the fracture might very well have been caused by direct violence.

FIG 7



FIG 8 - internal end of clavicle

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FIG 7



individual does not fall. When Dr. Thomas said that he does not believe that the opening or laceration in the capsule is ever so small that the head cannot be replaced, he was sure experimental work bore that out. The old theory of a slit in the capsule cannot be held by any one that has done any experimentation.

DR. D. L. DESPARD said that traction prolonged over a number of days possesses some advantages over the method of applying a great force only at the time when reduction is being attempted. The former method of traction was successfully used recently in the dislocation of the shoulder of an exceedingly muscular man. The injury had existed for over six weeks and he had anticipated a great deal of difficulty in effecting a reduction. By means of Buck's extension apparatus, traction was started with 6 pounds, which was gradually increased to 10 pounds and continued over a period of 8 or 9 days. The patient was then anesthetized and reduction effected by the Kocher method upon the first attempt.

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It was interesting, Dr Ashhurst thought, to recall that anæsthesia not only made reduction much easier, but that it demonstrated that it was not only the muscles which interfered with reduction. Though Kocher was the first to recognize that the ligaments were the main obstacle to reduction in dislocations of the shoulder, as Moses Gunn had been the first to recognize their action at the hip, Kocher's claim that the coracohumeral ligament acted at the shoulder as did the iliofemoral at the hip was demonstrated to be false by Farabeuf, who showed that the essential structure was the posterior part of the capsule.

The end results of dislocations of the shoulder formed an interesting subject. Though the reports of consecutive series of cases are meagre, it appeared that two out of three patients have been found to present persistent debility. Out of more than 20 patients under the speaker's own care, it had been possible so far to ascertain the end results only in five cases. In only two of these was perfect function regained, the three other patients were quite satisfied with their condition, though two of these had had the same shoulder dislocated twice or more subsequently,

and the third had distinct limitation of motion, though subjectively he claimed his shoulder was "all right"

DR. GWILYM G. DAVIS remarked that this discussion had broadened out into recent as well as old dislocations. Etherization eliminates the consideration of muscle resistance, but as regards the difficulty of replacing luxations if no anæsthetic is given, then the muscles play an important part as a hindrance to replacement, in shoulder luxations it is often thought unnecessary to give an anæsthetic. Then the elimination of the muscles must be undertaken by other means, hence it is that use is made of the methods of Stimson, Astley Cooper, and others, by direct traction, etc., all with the idea of overcoming the muscle resistance. When this is overcome by an anæsthetic then the bones and ligaments only are to be dealt with, and the reason that the luxation cannot at times be reduced under these circumstances is because, as Dr. Allis has shown in the hip, the arm is not placed in the correct position. Thus, when Stimson puts the arm through the sling he lets the weight swing and the arm swings round until the capsule is opened and the head slips in. The same thing occurs in the Astley Cooper method,—when the arm is rotated it opens the rent and in goes the head, and it is the same with all the direct methods. In the old method of hanging the patient over the top of a door, the arm rotates until the capsule is open to its greatest size, when the head will slip in. If traction is made in abduction and backward, absolutely eliminating the muscles by anæsthesia, then the only thing to do is to rotate until the capsule is open, and push the head in. If it does not go in, then there is an irregularity in the condition, it is not a true simple luxation but one complicated with a fracture, etc. When it comes to the method, the speaker agreed with Dr. Thomas that this is the proper method of reducing luxations of the shoulder. He had had several cases in which he had put the foot against the bedstead and pulled outward and backward and rotated, the longest time taken for reduction was fifteen minutes, while in others it was effected in three minutes. Keeler's method is unnecessary although effective if it is desired to reduce without an anæsthetic. Reduction does not depend solely upon the coracohumeral ligament. This ligament goes from the coracoid process, which is to the inner side, outward and in front. It has near it the long tendon of the biceps and the glenohumeral ligament. Above is that part of the cap-

sule which frequently remains untorn in the cases in which the Kocher method is effective. One can determine on the cadaver that when the upper and posterior parts are intact one can rotate the humerus, and the head will move out from the chest toward the glenoid cavity. But if that portion of the capsule is torn, the head will bore between the glenoid process and the side of the chest, and in order to reduce such a luxation all that is necessary is to proceed with the direct method as the capsule is all torn. In such cases the Kocher method is ineffective. In the old cases in which that part of the capsule is intact then the Kocher method is effective because one can wind the remaining portion of the capsule around the upper portion of the head of the bone and push it outward, and it pushes in the old cases the supraspinatus, infraspinatus, and teres minor off of the glenoid process and cavity. The Kocher is the most dangerous method, because if the external rotation is made when the arm is down by the side, as is so often taught, then the coracobrachial is stretched so firmly over the head of the humerus that the lesser tuberosity catches on it and prevents it being rotated outward, and not infrequently the head of the humerus is jammed so tightly between the glenoid process of the scapula and the side of the chest that if one persists in rotating outward one will fracture the bone. It is far safer to do a wide abduction and traction.

DR T. TURNER THOMAS (in closing) said that he did not mean to infer that the abduction method was new. It is much older than the Kocher method, but what he had tried to show was that one of the older methods is more effective than the new, or Kocher method, which has been the prevailing method almost from its introduction. In regard to the Stimson method for recent dislocations, the underlying principle is the same as that which he had been applying in old dislocations. With regard to the disabling limitation of movement after the reduction of old dislocations, if the dislocation has existed for many months before reduction, the chances for a complete return of function are small. He would not say that it is impossible to get it. The return of function will be more rapid and will more nearly approach the normal after a non-operative reduction than after an operative reduction, as a rule. The underlying cause of the difficulty is essentially the same as for the corresponding condition found after the reduction of recent dislocations, *i e*, the stiff and painful shoulder of which so much has been written in re-

showing an apparently typical hour-glass contraction of the stomach. The contraction was at the junction of the lower and middle thirds. It was clear cut, and about equally indented on both curvatures. The lumen of the contraction appeared to be about the thickness of the index-finger. Both pouches were well defined, and five minutes after the ingestion of a bismuth meal the pyloric pouch was filled with bismuth and some bismuth had already escaped into the small intestine. Six hours and fifty minutes later the stomach was empty and all the bismuth was in the colon, showing that there was practically a hypermotility.

In view of the X-ray and clinical findings, the diagnosis of an hour-glass stomach was made and an operation was decided on. This revealed an apparently normal stomach. At the junction of the middle and lower thirds of the stomach there was a suggestion of muscular hypertrophy, but there was no contraction of the lumen. A careful and systematic search was made of the pylorus, duodenum, gall-bladder and ducts, the appendix, and the site of the previous pelvic operation, and no gross pathological lesions of any kind could be demonstrated. The portion of the stomach proximal to the supposed contraction was inverted and stretched, and the abdomen was then closed. Since the operation, the patient had not vomited, she had gained 25 pounds in weight, and to all intents and purposes was perfectly well.

Dr Lyle called attention to the fact that the series of X-ray plates taken since the operation showed a perfectly normal stomach, and that with the operative and X-ray findings as a guide, the only diagnosis that could be made was that of an intermittent hour-glass stomach. This diagnosis, he thought, could have been made before the operation, based on the following points. The X-ray pictures should be taken on different days, at different times, and in different positions. The test for the capacity of the stomach should be taken at different times during the day and on different days. A careful study of the X-rays showed the regularity of the pouches, and the fact that the contraction involved both curvatures equally. (A well-marked ring-shaped contraction was not physiological.) We could also note the clear-cut outline of the contraction, the time in which the bismuth passed from one segment to the other, and the fact that the stomach, despite this contraction, emptied itself in six hours and fifty minutes.

dulness of left chest posteriorly In sixth left interspace in anterior axillary line was a stab-wound, about  $1\frac{1}{2}$  inches in length, from which bright red blood was flowing

From above symptoms and physical examination a penetrating wound of the chest was diagnosed with probable injury to the heart At 6 24 P M, 1 hour and 24 minutes after admission, the patient was given ether preceded by ethyl chloride The field of operation was sterilized with 3 per cent iodine solution and wound in interspace enlarged Left lung was found collapsed The sixth rib was then divided and retracted, and immediately a large opening was found in the pericardium The edges were rough and the wound appeared to be more like a tear than a clean cut There were a number of clots found in the pericardium, which when removed showed a transverse cut in the heart, from which at each systole there flowed bright red blood The cut in the heart was about one inch in length, apparently in the left ventricle about an inch above the apex A curved intestinal needle, threaded with fine Pagenstecher thread, was then passed through the cardiac muscle and tied, the ends being left long and used as a tractor in the introduction of the second stitch When the second stitch was tied, it was found that the wound was completely closed and the hemorrhage from the heart stopped The pericardium was then partially closed, after its cavity had been washed out with normal hot solution A small gauze drain was left in the wound and the retractor holding the rib withdrawn, and the wound closed with silk-worm-gut sutures There was no hemorrhage from the chest or pericardium, and no ligatures were used during the operation

Previous to the operation the patient was so well stimulated by the alcohol already imbibed, that he did not require any stimulation, either before, during, or after the operation He apparently left the operating table without any symptoms of shock, his temperature being  $96.4^{\circ}$ , pulse 88, respiration 32 Time of operation 22 minutes During the night he was given a sixth of morphine hypodermically, but this is all the medication he received The following morning his temperature rose to  $101^{\circ}$ , pulse remained about the same (92), respiration 36

On August 2, three days after admission, he developed delirium tremens, and was irrational for a couple of days On August 5 a to-and-fro friction rub synchronous with a heart-

and the third had distinct limitation of motion, though subjectively he claimed his shoulder was "all right"

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Bircher <sup>4</sup> reports a case of gun-shot wound of the heart which healed under conservative measures alone, and also reports a case of multiple stab-wounds of the heart requiring operative treatment, which case recovered. He goes on to say that only one stab-wound was found at the first operation and the second wound required suture twelve hours later. At the time of the second operation the wound first sutured showed that firm repair had already begun to take place. He states that conservative measures seemed more promising for gun-shot wounds, and intimates that operative procedures are necessary in all cases of stab-wound.

It is needless to say that all stab-wounds of the heart require surgical intervention, and that all wounds in the neighborhood of the heart should be explored, as this is the only positive method of determining the extent of the injury done.

When the symptoms of extreme shock accompany a wound of the chest in the cardiac region, the diagnosis is fairly sure of an injury to either the pleura, pericardium, or heart, but this cannot fully be determined without exploratory procedure, as in the case above cited, the symptoms were those of an injury to the pleura, whereas at operation we found not only the pleura injured, but the pericardium and heart as well.

As to the method of operating in these cases, I do not believe that any fixed rules can be laid down other than those of expediency. Usually the enlarging of the original wound (Peck) and the division of the costal cartilages, the retraction of which will allow a good exposure of the heart, is all that is required. Kocher and others suggest various flap methods. Kocher divides the fifth, fourth, and, if necessary, the third costal cartilages, while Wilms recommends the intercostal incision, as it can be much more quickly performed than the various flap methods. In the majority of heart wounds the pleura is injured. Sauerbruch says that 80 per cent of the cases are so complicated.

As to the suture material, either well-vaselined silk, chromicized catgut, or Pagenstecher may be used. In our case Pagenstecher thread was the one selected. No doubt the use of the differential pressure apparatus is of great advantage in the administering of the anæsthetic, but when this apparatus is not available, ether, by the drop method, is the most efficient method.

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<sup>4</sup> *Archive für klinische Chirurgie*, Berlin, vol. xc ii, No. 4, pages 831-1075, last indexed, April 27, page 1318.



beat was noted to the right of the sternum at level of the third rib. This disappeared in three days. There apparently was no increase of cardiac dulness or other signs of cardiac effusion. Temperature at this time was  $100^{\circ}$ , pulse 100, respiration 28. Drain was removed on August 17. Patient sat up in bed at this time. On August 21 dulness in the left chest posteriorly, with distant breath sounds, was noted over this area. Temperature  $102.3^{\circ}$ , pulse 124, respiration 28. On August 26 chest was aspirated and about eight ounces of a dark reddish, clear fluid evacuated. Upon culture this was found to be sterile. On September 14 chest was again aspirated, but only a small quantity of the same sort of fluid obtained. From this time on, patient rapidly improved. Signs of fluid in left chest diminished and when patient left the hospital on October 19 there was but slight dulness over left chest posteriorly, probably due to a thickening of the pleura. The heart at this time seemed to be slightly pulled to the left, apex beat being in sixth interspace one inch to the left of the nipple line. There were no murmurs present, sounds regular but a trifle rapid. Dr. Mitchell added that so much has been written of late as to the treatment of heart wounds that it does not seem necessary at this time to go very deeply into this subject.

König<sup>1</sup> in his article on "Technic for Access to Suture of the Heart," gives a full discussion on this subject, and Poole,<sup>2</sup> gives a most exhaustive study of the technic, as well as the bibliography of recorded cases up to the year 1912. He has succeeded in tabulating 77 cases of heart suture, which added to those already tabulated in 1909 by Peck totals 236.

Ranzi<sup>3</sup> gives Rehn the credit of publishing the first successful case of heart suture in 1896, and has collected 223 operative cases with a mortality of 53.3 per cent. He adds to this number three cases of stab-wound and also three of gun-shot wound of the heart, who were operated upon in Von Eiselsberg's Clinic at Vienna but only one of which recovered. He mentions in the successful case, that five hours intervened between the time of injury and operation, and states in naming the time of the operation that the anemia was not very marked.

<sup>1</sup> *Deutsche Zeitschrift für Chirurgie*, vol. cxv, No. 4 and 6.

<sup>2</sup> *Annals of Surgery*, April 1912.

<sup>3</sup> *Wiener klinische Wochenschrift*, Vienna, Dec. 14, vol. xxv, No. 50.

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The pericardium may or may not be completely closed. If there is much injury it is better to partially close it by interrupted sutures and carry a small drain down to the opening that is left so as to drain the excessive serous discharge which is apt to occur as a result of the traumatism. Drainage of the pleural cavity may or may not be done at the primary operation, it depends on the likelihood of infection. In doubtful cases it should always be performed. Poole says it is better to delay drainage until infection has occurred and then to perform a secondary thoracotomy.

DR FRANCIS T STEWART remarked that it was an error to give credit to Rehn, of Frankfort, for the first suture of the heart. Farina and Cappelen each operated in 1896, but the patients died. In 1897 Rehn published the first successful cardiorrhaphy. So far as he was aware there had been 11 cases of suture of the heart in Philadelphia, one by Dr Mitchell, two by Dr Gibbon, one by Dr Bradbury, one by Dr Billings, one by Dr Harte and five by himself, nine of these having been cared for at the Pennsylvania Hospital. As to the diagnosis, in the beginning it is often a matter of doubt. He had explored a number of thoraces for wounds and had found only five cases in which the heart was wounded, although in many a wound of the heart was suspected. Simply from the degree of shock no conclusion can be drawn. He remembered one case of stab-wound over the heart which appeared as if there must be a wound in this organ, but it was found on examination that the knife had not penetrated the thorax, the patient suffering only from emotional shock. In some of the cases in which the thorax is penetrated the heart is seriously disturbed because of so-called concussion of the heart, the heart being merely bruised. This is more frequent in gun-shot wounds. In several cases that he had explored the pericardium had been wounded but not the heart but the symptoms were indicative of a wound of the heart. The most reliable symptoms, when they exist, are those of compression of the heart (cyanosis, distention of the veins from pressure on the auricles, etc.) These symptoms are not conclusive, however, because effusion of blood into the pericardium may result from wounds of the vessels of the pericardium or the great vessels at the base of the heart. The site of the wound is usually, over the heart, although in some cases it is in the axilla or even in the abdomen. No conclusions can

be drawn from external bleeding, because serious bleeding may proceed from a wound of the internal mammary artery or from the intercostals. The diagnosis can be assured only by exploration. His own custom in these cases has been to incise the skin, if the wound penetrates the muscles, to incise the muscles, if it penetrates the thorax, to enlarge the wound throughout its entire depth and to expose the pericardium, if a wound is found in the pericardium, to enlarge that wound, perhaps by resection of a rib above or below, or both. But if, on exploration, the symptoms of a wound of the heart being present, it is found that the pericardium has not been wounded, or no wound is discovered, then the pericardium should be punctured with a needle, because, although one who has had no experience in this class of surgery may think it easy to determine whether or not blood is in the pericardium simply by inspection, it is not always an easy matter, as has been proved by several reported cases. If there is doubt after a needle has been put in the pericardium, this membrane should be incised in order to allow full exploration. As to the method of exposure, it is a matter of expediency. The size and shape of the incision or flap must be determined by the situation of the external wound and the situation of the stab in the heart. If a flap, consisting of one or more ribs, is turned inward, the pleural cavity will always be opened. If a flap is turned up or down double section of the intercostals is necessary. Whenever possible the flap should be turned outward, toward the arm. In this way, if need be, the pleura can be separated without injury, and the exposure made extrapleurally, as in one of his cases, a wound of the auricle, where he was able to make a large flap, to push off the pleura, which was not wounded by the knife, to expose the pericardium over a wide area, and to suture the wound in the heart without injury to the pleura, the patient made a rapid recovery. If the pleura is wounded infection usually follows. About one-half of the cases die of empyema of the pleural cavity or pericarditis or infective myocarditis, etc., so that if infection can be avoided the number of recoveries will be vastly increased. Of those that recover, about one-third do so in spite of infection. Of the five cases operated on by himself three recovered, two in spite of infection. As surgeons now recognize that wounds of the heart should be sutured and it has been demonstrated

that the hemorrhage can be controlled, the greatest problem is to learn how to prevent the infection. He mentioned three things as being of some value in this direction. First, the rapid disinfection of the skin with iodine. In most of the cases he had operated on he used soap and water, alcohol, and bichloride of mercury, which takes a little too long, if done properly, and is not very sure if done hurriedly. With a 10 per cent tincture of iodine solution the disinfection can be done rapidly and certainly. In the second place, if possible, drainage should be avoided, careful hæmostasis should be made and clots removed as those which remain either form adhesions or encourage infection. If empyema arises later it can be drained. Third, that the presence of air in the pleural cavity must if possible be avoided, at least after operation. He did not know of any case having been operated on with the positive or negative pressure apparatus. In his last case he intended to use a home-made Auer-Meltzer apparatus, but the different parts could not be assembled quickly enough. The question arises, however, as to whether suction upon or distention of the lung may not increase the bleeding. If a positive or negative pressure apparatus is not at hand, the air in the pleural cavity should be removed by aspiration, after the wound in the chest is closed. A pleura full of air contains a large number of bacteria, which, after they have settled on the pleura give rise to infection. If the lung can be expanded the chances of infection will be less. In one case in which he opened the thorax for exploration, finding a wound of the lung and not of the heart, the patient was treated in this way and recovered without difficulty or infection.

DR W JOSEPH HEARN said that a few years ago a colored woman was brought to the Jefferson Hospital one morning with evidence of puncture of the heart (stab-wound), and one of his medical delegates examined her carefully with the stethoscope and was satisfied there was leakage from the heart and suggested immediate operation, which he attempted. He made a U-shaped incision, turning the two bows of this flap toward the sternum, and avoided cutting the mammary vessels. He made an incision through which he could almost put his hand, and after washing out with salt solution, found an opening one inch long in the pericardium. The pericardial wound was enlarged sufficiently to see there was no wound of the heart.

merely a scratch, which had been made by the point of the knife. It was simply a wound of the pericardium into which he put 2 or 3 sutures, closing the wound without drainage. The woman 2 years later died of phthisis. His method of exposure gave a good view of the heart without much hemorrhage. The only difficulty encountered in sewing up the pericardium was the heart movement.

## PERIRENAL HÆMATOMA

DR. JOHN SPEESE read a paper with this title.

DR. FRANCIS T. STEWART remarked that he had never seen a spontaneous perirenal hæmatoma, but when Dr. Speese read his explanation of the tympanites it reminded him of the tympanites of other renal lesions, particularly of renal colic, which must be purely nervous in origin. On two occasions he had been asked to operate on a patient for intestinal obstruction who was found to be suffering from renal colic, and recently he had seen another case of the same character.

DR. CHARLES H. FRAZIER was reminded of a case presented by him to the American Medical Association five or six years ago. This was a young man 25 years of age, who was brought to the hospital 36 hours after the onset of his illness, believed to be suffering from an acute abdominal lesion. Upon examination after admission there was found board-like rigidity of the right side, exquisite tenderness on pressure midway between the appendix and gall-bladder, and also tenderness, but not to the same degree over the right kidney. There was marked acceleration of the pulse, leucocytes were 25,000, and an elevated temperature was present. An exploratory incision was made in the right rectus, nothing was found in the peritoneal cavity and the wound was closed. An incision was then made over the right kidney. A very large perirenal hæmatoma was exposed. Drainage was introduced and the patient made an uneventful recovery. The hemorrhage was attributed to a cortical tubercular lesion. The patient had pulmonary tuberculosis.

## AN APPROACH TO THE HYPOPHYSIS THROUGH THE ANTERIOR CRANIAL FOSSA

DR. CHARLES H. FRAZIER read a paper with the above title, for which see page 145.

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orbit and the patient developed a panophthalmitis Dr Shoemaker, who performed the enucleation, stated at the time that this condition was a not infrequent complication of fractures involving the orbit It had occurred to him that in the operation described by Dr Frazier, some such pathological condition in the eyeball might result

DR CHARLES H FRAZIER remarked, in response to what Dr Jopson had said of involvement of the orbit, that great care should be exercised in separating the periosteum from the roof of the orbit before any attempt is made to remove the bone The periosteum is quite thin there and may be readily torn unless one proceeds cautiously It is rather presumptuous at this juncture to say that the transfrontal method of approach will be preferred to others, particularly the transphenoidal route He could not, however, help but feel that surgeons will never become accustomed to working through such a long and contracted avenue as is necessary when approaching the sella through the sphenoidal sinuses For the nasal specialist who is accustomed to open and drain the sphenoidal sinus, it may be a simple matter to go a step further and remove the thin shell of bone which forms the floor of the sella turcica Or if nothing more than the removal of the floor of the sella, a sella decompression, is contemplated, the transphenoidal route may be given preference; but if one wants an exposure of the sella turcica sufficient to enable one to see the character of the lesion to be dealt with, some method other than the intranasal method of approach will be found to be absolutely essential

#### THE FORMATION OF AN ARTIFICIAL VAGINA BY INTESTINAL TRANSPLANTATION

DR FRANCIS T STEWART read a paper with the above title, for which see page 210

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# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS.

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### MYOSITIS OSSIFICANS TRAUMATICA.\*

A REPORT OF THREE CASES ILLUSTRATING THE DIFFICULTIES OF  
DIAGNOSIS FROM SARCOMA

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CASE I—*Myositis ossificans traumatica of quadriceps extensor*—J B N, the patient, a boy of nineteen, had always been in good health up to November 17, 1906, when he received an injury to his right thigh while playing football. There was no external evidence of the injury noticeable that night, but the next day there was some swelling, two to three days later the leg became stiff, and the stiffness seemed to be confined to the region of the quadriceps muscle, greatly limiting the flexion at the knee. There was no pain at any time, but the swelling steadily increased in size. The patient at first believed the swelling to be in the muscle rather than the bone. The swelling slowly began to get hard and contract, the patient's general condition remained unimpaired. He was examined by a number of prominent surgeons and all agreed that the trouble was sarcoma, and amputation was advised. My opinion was asked by letter, and I replied that if the trouble was sarcoma I would advise a brief course of the mixed toxins treatment before amputation. Thereupon the toxins were administered for about four weeks with little reaction and no apparent effect on the size of the tumor. I declined to give further advice without seeing the patient, and he

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\* Read before the New York Surgical Society, December 11, 1912

was referred to me early in April, 1907, by Dr Wm D Haggard, of Nashville, Tenn. Physical examination showed a tumor situated in the middle and lower thirds of the anterior portion of the shaft of the left femur. The consistence of the tumor was extremely hard, much harder than usual in periosteal sarcoma. The X-ray photograph showed a sharp line of demarcation between the tumor and the shaft of the femur along the periosteal line, with no indentations in the periosteum. I made the diagnosis of myositis ossificans and under ether removed a piece of the tumor for microscopical examination, and advised no further treatment. The patient has continued in good health up to the present time, 5¾ years later. The specimen was examined by Dr Jas Ewing, Professor of Pathology at Cornell University Medical School. This report reads as follows:

April 12, 1907. Material received consists of several small masses of bony tissue. After hardening in Muller-formol and decalcifying, sections were stained in eosin and hæmatoxylin. The tissue is composed of numerous trabeculae of bone, round, elongated, branching, and anastomosing, as in cancellous tissue. These masses are usually well calcified, but some are deficient in ossification, in the centres where the material stains bluish. They are often surrounded by numerous large osteoblasts which are evidently in the process of bone formation. In a few areas there are scanty giant osteoblasts, lying in lacunae or at some distance from the bone tissue. Between the bony trabeculae the tissue is composed of cellular connective or of fat. The connective tissue is very cellular and appears to be of new formation. The fat tissue is inflamed, infiltrated with new cells, chiefly lymphocytes, and the fat is being absorbed. There are no traces of muscle tissue in the section.

Dr Ewing stated that the condition was one usually termed myositis ossificans traumatica, though chronic productive osteitis might be a better term.

Under date of November 13, 1912, the patient writes

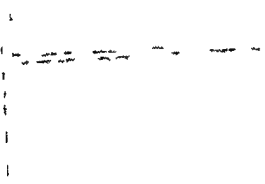
"On palpation I cannot notice much reduction in size of the growth. The interference with movement is very slight, being able to almost completely flex my leg. It gives me no trouble at all, save for an occasional slight uneasiness just sufficient to attract one's attention. My general health is good."

The first X-ray illustration shows the condition prior to operation.

The second X-ray photograph, taken by Dr A F Holding,



Myositis ossificans, 1907 (Case I)

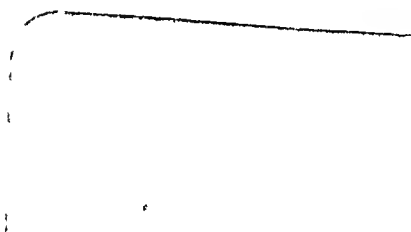


5 3/4 years later, December 1912 (Case I)





Osteitis ossificans (Case I)





*Myositis ossificans* 1907 (Case I)



*Myositis ossificans*, 1907 (Case I)



1009-July 1911 (Case II)



Normal Face (Case II)



1009-July 1911 (Case II)

December 11, 1912, shows the condition almost identical with the second radiograph of Mr Makins's case, taken six years afterward. It shows that much of the original bony tumor has been absorbed.

NOTE—The patient, now a physician, was shown before the New York Surgical Society Dec 11, 1912.

CASE II—*Myositis ossificans of muscles and ligaments, lower end of femur, becoming sarcoma six years later*—The patient, Miss A, aged twenty-six, had always been in good health, negative family history. Seven years ago she was thrown from a carriage in a runaway accident, and received a very severe blow on the lower and outer part of the left thigh, just above the knee. After the immediate effects of the contusion had subsided she noticed nothing unusual until about two years later, when, on bathing, she saw that the left thigh just above the knee was somewhat larger than the right. There was no pain, no soreness, no lameness, the increase in size being the first sign she noticed. She consulted a physician who found a slight bony enlargement above the outer condyle of the left femur and an X-ray photograph was taken at that time, which showed a small bony tumor projecting about half an inch beyond the normal border of the shaft of the femur, not extending to the joint. This increased in size very slowly, was not painful and caused her no trouble. On February 9, 1909, the patient consulted a very prominent surgeon of the Middle West, who pronounced it subperiosteal sarcoma and advised hip-joint amputation. She was made very nervous by this decision and went abroad for two months to get in better physical condition. On her return, on May 3, she again consulted another very prominent physician of Chicago, who stated that she was suffering from a fibrosarcoma of the femur of periosteal origin. He stated that there was no possible doubt of the diagnosis and advised immediate amputation below the trochanter and urged this being done without a day's delay. She was brought to me for advice on May 5, 1909, by her family physician, Dr Mary Spark of Indianapolis. Physical examination showed the patient in good general condition, examination of the left thigh showed a hard, bony tumor in the lower third of the left femur, smooth in outline, extending upward about two and a half inches, most marked on the outer side. Although it extended apparently nearly around the bone, the skin was perfectly normal in appearance and there were no enlarged veins. Comparison between the X-ray taken

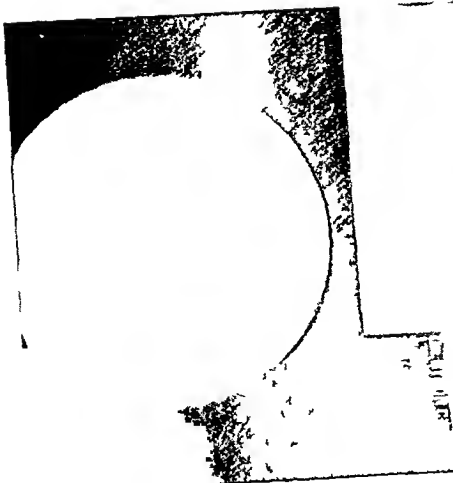


a year ago and that of a few days ago showed some increase in size and extension across toward the other side of the femur; no involvement of the joint, and interior of bone not involved

In both these cases there was a well-defined sharp line of demarcation between the bone and the tumor, differing strikingly from the irregular indentation almost always present in the case of sarcoma. The consistence of the tumor, too, was much harder and more bony in character than in true sarcoma. I believed the tumor to be some type of myositis ossificans originating from the trauma, and not sarcoma. I advised an exploratory incision under general anæsthesia and removal of a section of the tumor for microscopic examination. This was done on May 7. An incision three inches in length was made over the external condyle, the most prominent part of the tumor, on cutting through the fascia overlying the muscles and separating the latter, no periosteum could be recognized, a hard, bony tumor was found in close proximity to, and infiltrating, the muscles. A portion of this was removed with a chisel. Macroscopically it had every appearance and the consistence of cancellous bone tissue, deep red in color and in no way resembling the grayish-white appearance of sarcoma. This was sent to Dr. James Ewing, Professor of Pathology at Cornell University, who, after decalcification, made a careful examination and reported as follows:

May 17, 1909. Seven different portions of the material received are under examination. In none of them is there the slightest trace of any form of sarcoma. The tissue shows chronic osteitis and myositis, such as commonly arises after traumatism to the bone or periosteum. The changes in the muscle are not those typical of myositis ossificans and yet new bone appears to be forming in close proximity to the atrophying muscle. I should prefer to give the diagnosis of chronic formative osteitis.

The history of this case thus far was related in my paper on "A Plea for More Conservative Treatment of Sarcoma of the Long Bones" (*Journ of the Am Med Ass'n*, Jan 29, 1910), but it is the later history of the case that has proved of particular importance and which makes it, as far as my own search of the literature goes, an entirely unique case.



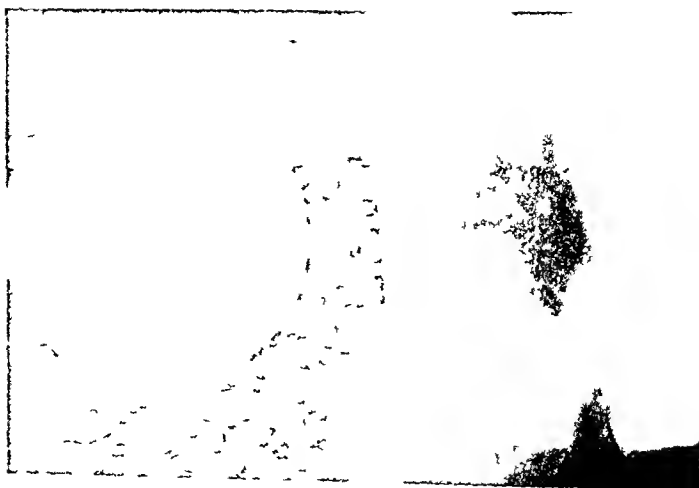
Interval 2 years 5 months—May 1909—October 1911 (Case II)



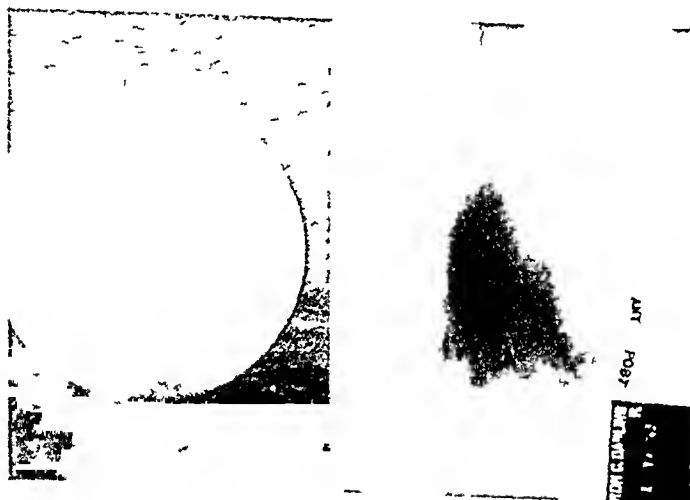
Interval, 2 years 5 months—May, 1909—October, 1911 (Case II)



Interval 2 years 8 months—May, 1909—January 1912 (Case II)



Interval 2 years 8 months—May 1909-January 1912 (Case II)



Interval 2 years 11 months—May 1909-April 1912 (Case II)

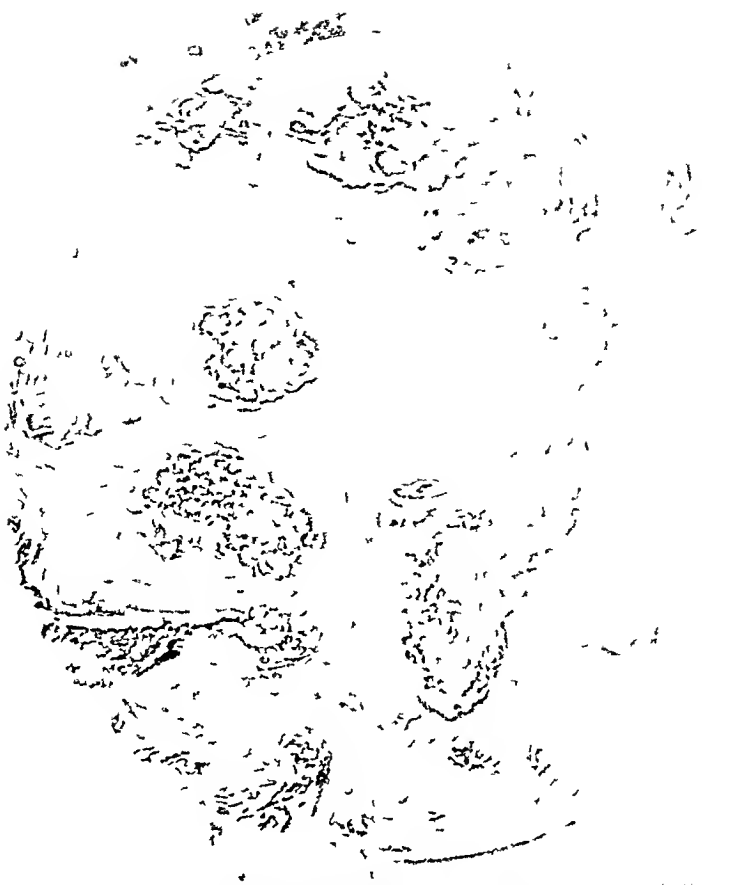


The wound healed by primary intention, and at the end of two weeks the patient returned to her home in the Middle West. She continued to enjoy perfect health and was able to ride horseback and play golf without any inconvenience. Two years later, in June, 1911, she called upon me while passing through the city and I examined the knee carefully. Physical examination showed a slight increase in the bony enlargement at the outer and posterior side of the femur and some thickening of the entire lower end of the shaft, just above the joint surface. There was very slight limitation in motion of the joint, and her general health was excellent. The tumor seemed to be of bony hardness, entirely different in consistency from the ordinary sarcoma. There was practically no change in its appearance from that of two years ago, except the slight increase in size already noted. An X-ray taken at this time by Dr. Darling and compared with the X-ray taken two years before also showed some increase in size and a less sharply defined periosteal line. I advised the patient to see me again in the fall on her return from the country, in order to have another examination made and X-ray taken. Owing to my absence in Europe, I did not see her until January, 1912. At this examination the enlargement seemed even more appreciable than it had been in June and I strongly advised another exploratory operation, thinking that possibly some change had taken place in the nature of the tumor. On January 8, assisted by Dr. Wm. A. Downes, my associate, I made an incision six inches long over the outer aspect of the lower end of the femur, and found a very hard, bone-like swelling, firmly fixed to the femur, in its upper portion, but in its lower portion there seemed to be a mass about the size of an olive that was slightly movable. This proved to be a bony tumor of typical cancellous structure, so hard that it could be cut only with a chisel. It was in no way connected with the periosteum or the femur, but apparently originated in the fascial portion of the adductor muscles just above their insertion, very closely attached to yet distinct from the larger bony mass which was continuous with the shaft of the femur. The smaller tumor was removed and the larger tumor mass was chiseled off on the anterior, lateral, and posterior portions, down to the level of the normal line of the femur. Nearly half a teacupful of bony material was removed, which, macroscopically, had the appearance

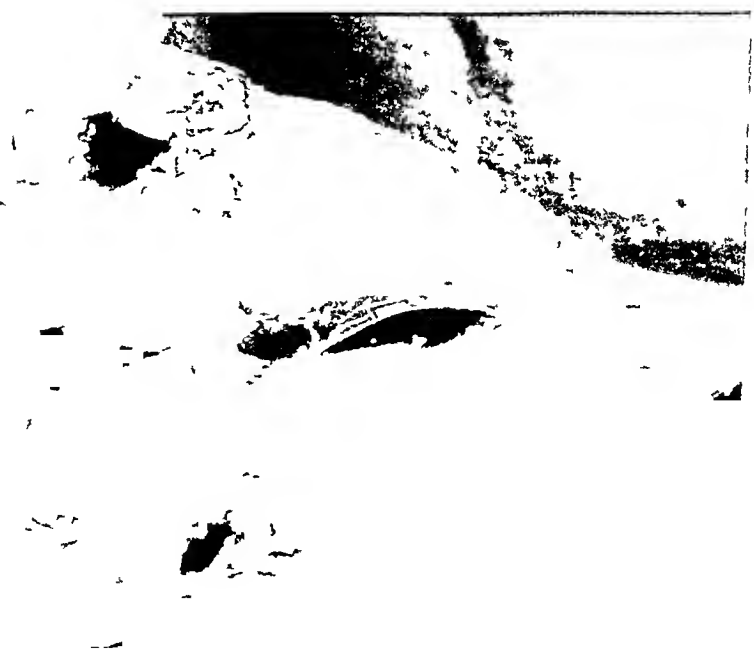
of healthy red normal cancellous bone, and in no place was there anything in any way resembling or even suggesting sarcomatous growth. All the material was sent to Dr Jas Ewing, Professor of Pathology at Cornell University Medical School, who, after careful examination, made the following report

Feb 15, 1912 The tissues in the case of Miss A show the usual and some unusual changes of myositis ossificans. The process begins with fibrosis and atrophy of the muscle-fibres and the production of dense connective tissue. This is then followed by increased vascularity, and many islands of bone and some of cartilage are deposited. In the new connective tissue there are many very cellular areas with giant-cells which resemble those seen in giant-cell sarcoma. I do not think the process can be regarded as a tumor in all respects, but these cellular areas explain why it is persistent and progressive. It is on this evidence also that many assume that myositis ossificans is a true tumor process. At any rate I do not like the presence of these large cell groups. In all other respects the case is typical of active myositis ossificans.

The skin wound was closed, with a gauze packing into the cavity which was of considerable size. The wound healed without any suppuration, and after ten days the patient was allowed to get up and rest upon a couch. A small drain was kept in the cavity for about six weeks, and finally the opening closed entirely. At the end of eight weeks the patient was allowed to go about on crutches. She seemed to have less power in the leg than was to have been expected, and there were occasional attacks of pain which had never occurred before. Two days before the patient's departure for home, there suddenly appeared a moderate effusion in the joint. The latter was strapped and bandaged and she was instructed not to use the leg for a few days, after which the swelling nearly subsided. She then (February 22, 1912), returned to her home in the Middle West, but the pain continued, she developed a slight temperature,  $99^{\circ}$ – $100^{\circ}$ , and a swelling appeared over the central portion of the incision at the site of the drainage opening. This swelling increased daily, the pain became more severe, and becoming somewhat nervous about her condition, she returned to New York on March 20. Physical examination at this time showed a marked protuberance over the whole line of incision, greatest at the central point, amounting to a projection of 1–1½ inches over the normal surface. The skin was smooth in outline, slightly purplish from enlargement of superficial veins, and semifluctuat-



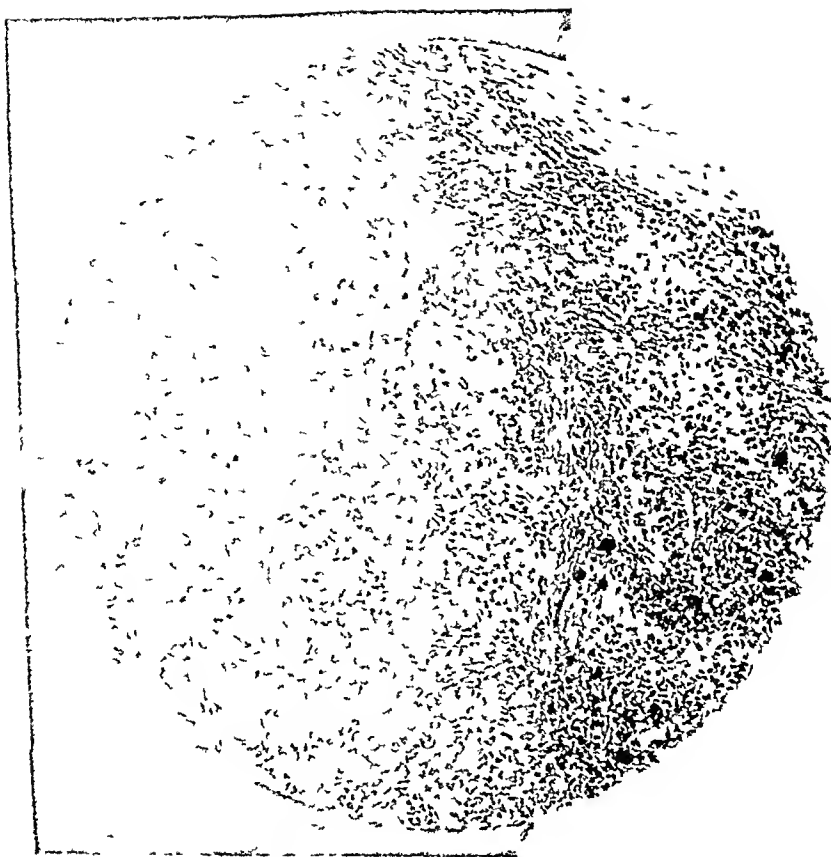
Myositis ossificans      Microscopical section   May, 1909      (Case II )



Central portion ivory-like bone      Giant celled sarcoma of  
lower and external portion, March, 1912      Death from meta-  
stases in pelvis and spine      January 12, 1913      (Case II )



Myositis ossificans, January, 1912 (Case II)



Giant-celled sarcoma, March, 1912 (Case II)

Myositis ossificans May, 1909 (Case II)



Myositis ossificans having become sarcoma March 1912 (Case II)



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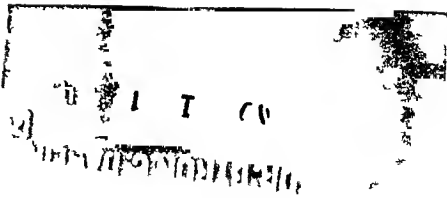




Myositis ossificans May, 1909 (Case II)



Myositis ossificans having become sarcoma



March, 1912 (Case II)

ing over the central area. In other words, the character of the tumor had entirely changed, and the clinical appearance was absolutely typical of a rapidly growing sarcoma. The introduction of a needle drew only blood. The swelling had come on so suddenly and was so soft as to be almost fluctuating, that the possibility of an accumulation of blood or serum in the old cavity was considered though not regarded as probable. Under cocaine I immediately made a small incision and curetted  $\frac{1}{2}$  oz of soft grumous material, which, clinically, had every appearance of sarcoma. This was examined by Dr Ewing and pronounced giant-celled sarcoma. His report reads as follows:

April 15, 1912. The sections of the myositis ossificans have been completed. They show areas of ordinary myositis ossificans grading into very cellular areas and finally into sarcoma of giant-cell type. There is no doubt that sarcoma is the final expression of the myositis process. As you know, these giant-cell sarcomas are not always very malignant, and I am inclined to think that this one is not, but as it occurs in a peculiar condition I would prefer not to offer any prognosis.

Dr V P Gibney and Dr Wm A Downes were called in consultation, and after careful deliberation it was decided best to try the effect of the toxins for 2-3 weeks before sacrificing the leg. The patient's general condition had greatly deteriorated within the last few weeks, she was extremely nervous and apprehensive, and unable to bear more than minute doses of the toxins, not sufficient to cause any marked reactions. As there was no retardation of growth noticeable at the end of two weeks, it was decided to amputate. Accordingly, on April 22, 1912, I amputated the leg 5 inches below the trochanter. The wound healed by primary union, but the patient recovered her strength very slowly. It was intended to continue the toxins as a prophylactic against recurrence after the wound had healed, but her general condition was so poor that it was considered unwise to do so.

It should be mentioned that for a number of years she had had enlarged glands in both cervical regions, these glands increased somewhat in size during the last year, but whether they represent metastatic growths or are the result of an old tuberculous process it is impossible at present to say. During November she developed very severe sciatic pains and pain in pelvis and back, accompanied by gradual loss of strength. She contin-

ued to grow worse and at present there is no doubt that she is suffering from metastases

NOTE—She failed rapidly and died January 12, 1913 A letter from her physician, Dr Carleton B McCulloch, stated that she had undoubtedly metastases in the lumbar and dorsal vertebræ

CASE III—*Myositis ossificans of the quadriceps extensor muscle*—C H, 16 years of age Patient had always been well until the beginning of November, 1912, when, while playing football he received a severe blow in the left quadriceps muscle, which knocked him down He did not notice anything until the next day when he found the leg very stiff and swollen, being one inch larger in circumference than the right, he could not bend the knee at all, there was no ecchymosis Patient was referred to me by Dr B H Whitbeck Physical examination, December 19, 1912, shows a hard, bony swelling, fusiform in shape, occupying the anterior and middle portion of the left femur, most protuberant in its central portion, firmly fixed, measuring eight inches in length The skin is normal in appearance and not adherent, motion at the knee is very greatly limited, extension normal, flexion very slight, not over  $15^{\circ}$ – $20^{\circ}$  The bony tumor seems to lie just beneath the skin and apparently involves the quadriceps muscle Measurement over the most protuberant part of thigh, left  $17\frac{1}{2}$  in, right  $16\frac{3}{8}$  in There is no pain, walk somewhat unstable, the leg occasionally giving way, general health good Examination of the X-ray photograph taken six weeks after the injury shows a fusiform tumor, apparently projecting about one inch beyond the periosteal border The outline of the periosteum is distinctly marked, there are no indentations as ordinarily observed in sarcoma In other words, the picture is almost identically the same as that shown in Case I The photograph was taken by Dr Byron C Darling

NOTE—This case was observed the week following the reading of my paper and was kindly referred to me by Dr Whitbeck, who made the diagnosis, having noticed its striking similarity to my cases just reported at the Surgical Society.

A careful study of 120 cases of sarcoma of the long bones, personally observed, has led me to the following conclusion.

The diagnosis of sarcoma of the long bones in the majority

of cases can be correctly made from a careful clinical history of the case, a thorough clinical examination combined, if possible, with a good radiograph. In most cases it is wiser to do an exploratory operation and remove enough of the tumor for microscopical examination, in order to render the diagnosis beyond question. This is important—no matter what form of treatment be advocated. If the toxins of erysipelas and *Bacillus prodigiosus* are to be used before operation in the hope of avoiding an amputation, it is important that the nature of the tumor be settled beyond doubt, as it would be unwise to subject the patient to a long and none too agreeable course of toxin treatment if the disease were not sarcoma, and if it is sarcoma, and the patient recovers without the sacrifice of the limb, the value of the case from a scientific point of view is greatly enhanced if the diagnosis has been further confirmed by a microscopical examination. If amputation or even resection be the treatment decided upon, there is still stronger reason for having the diagnosis previously confirmed by microscopical examination.

Many objections have been raised against the wisdom of exploratory operations in malignant tumors in general, and particularly in sarcoma of the long bones. These objections have greater weight with English surgeons than with American. Some of these objections it must be granted are well taken, *e g*

(1) The exploratory operation itself may cause grave risk, setting free, tumor cells in the circulation, thereby favoring general metastasis. While this result may possibly occur, long experience has shown it to be largely a theoretical objection rarely supported by clinical facts. A sufficient answer would be that the gain of having the diagnosis confirmed without question greatly outweighs the very slight and even problematical risk of general dissemination.

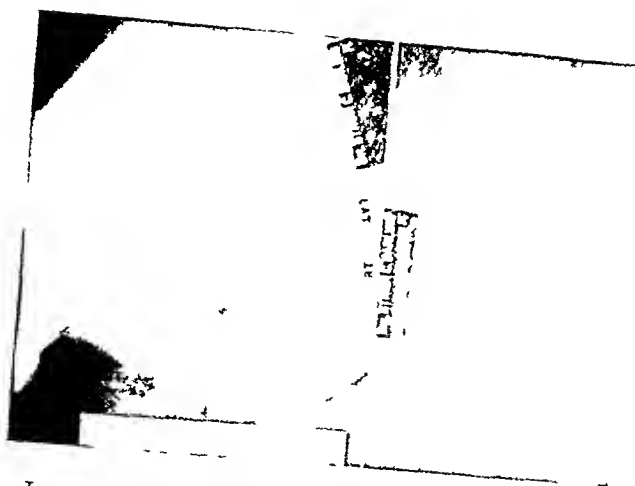
(2) Another objection and one that I think has more weight is, that the exploratory operation is often a very difficult one, especially in sarcoma of the lower end of the femur, particularly if situated posteriorly in the neighborhood

of the popliteal vessels I have seen serious hemorrhages in several such cases, and in two cases found it very difficult to control them. However there is another objection which I consider of greater importance, and that is

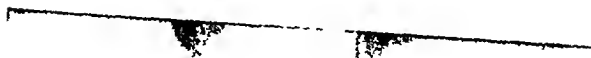
(3) The danger that such a deep wound may never heal, and if it does not heal it almost inevitably becomes infected, and the lack of good drainage may cause such severe septic intoxication, that amputation may have to be performed

I will here cite two cases which well illustrate the dangers from exploratory operation in not easily accessible regions

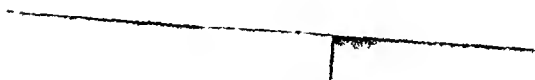
CASE IV—*Central sarcoma of the femur, giant-celled type*—A J M C, male, aged forty-one years. Family history negative. Previous personal history unimportant. States that he had some pain in the knee in October, 1909. November 1 stumbled while going upstairs and injured right knee, which immediately became badly swollen and caused a good deal of pain, was treated as acute synovitis, unable to walk for a day or two. Under electrical treatment and massage for two weeks there was marked improvement, and he was able to walk without a cane. The swelling, however, never disappeared. In the spring of 1910, at the Massachusetts General Hospital he was operated upon, a  $3\frac{1}{2}$ -inch exploratory incision over the internal aspect of the patella being made. No disease was found. Two days later an incision was made over the outer side of the patella and a tumor was found occupying the lower portion of the outer condyle. The wound was packed with iodoform gauze and bismuth paste, a sinus remained which never closed. His general condition remained good. The mixed toxins were started immediately after the operation. His weight increased from 190 pounds to 203 pounds. The first six injections with the toxins caused no reaction, the seventh produced a severe chill, followed by a temperature of  $104^{\circ}$ . After twelve injections, he returned home and had the treatment continued there. Two months later an X-ray plate was taken and as there was apparently some increase in size, amputation was strongly advised. Six weeks after this two other X-rays were taken and again amputation was strongly urged. The patient was brought to me by his brother, who is a physician, on January 23, 1911.



Interval 3 months—March 1911—June 1911 (control specimen of femur controlled by the mixed toxins for nearly one year) (Case IV)



Interval 6 months—March 1911—September 1911 (Case IV)



Interval, 1 year 2 months—January 1912—March 1912 (Case IV)



Examination at this time showed very slight enlargement of the lower end of the femur, chiefly in the region of the knee-joint, there was slight fluctuation in the joint and some redness of the skin. There was a scar about  $3\frac{1}{2}$  inches long on the inner side of the knee, and an unhealthy looking sinus above the joint from which there was a profuse discharge of pus of a greenish tinge. There was a small enlargement of the lower end of the femur itself, most marked over the outer condyle. Measurements 9 inches above the patella are the same on both sides, showing that there is no atrophy of the muscles. I had an X-ray photograph made at this time, which, compared with the earlier photographs, showed little if any increase in size. In view of the previous diagnosis of sarcoma of the giant-celled type, it seemed to me unwise to amputate the leg without a more thorough trial with the toxins. The patient was sent to the General Memorial Hospital and a few days later, in order to establish better drainage, I made an incision over the old sinus and curetted out a considerable amount of tumor tissue, mixed with pus and bismuth paste. Microscopical examination showed it to be sarcoma of the giant-celled type. I found it extremely difficult to control the hemorrhage, and only succeeded by introducing gauze packing very tightly. A very severe attack of toxæmia followed, with a temperature of  $104^{\circ}$ – $105^{\circ}$ . The patient was in a serious condition for two or three days. On recovering from this, I at once put him on the mixed toxins, beginning in small doses, and gradually working up to the point of getting a reaction of  $102^{\circ}$ – $103^{\circ}$ . The wound was drained with a large tube. After a short time the patient's condition became normal, he was sent home and the treatment continued by his brother, with occasional intervals of rest. During the treatment, X-ray photographs were taken every four or five weeks to determine whether or not there was any increase in the growth, none could be made out and there was apparently a decrease of tumor tissue with substitution of normal bone (vid illustration).

The patient's general health remained perfect in every way, he weighed more than he ever did, he went about comfortably with a cane, the sinus remained open, however. In the beginning of January, 1912, after about one year's treatment, a portion of the rubber tube became broken off in the wound, causing infection of the sinus followed by a severe attack of toxæmia.



His condition became so serious that in the mind of Dr C A Porter of Boston and the other physicians attending him, it seemed necessary to amputate the leg in order to save his life. Examination of the tumor after operation showed little or no increase had taken place during the year of treatment.

I am just in receipt of a letter from Dr C A McCarthy, the patient's brother, who states

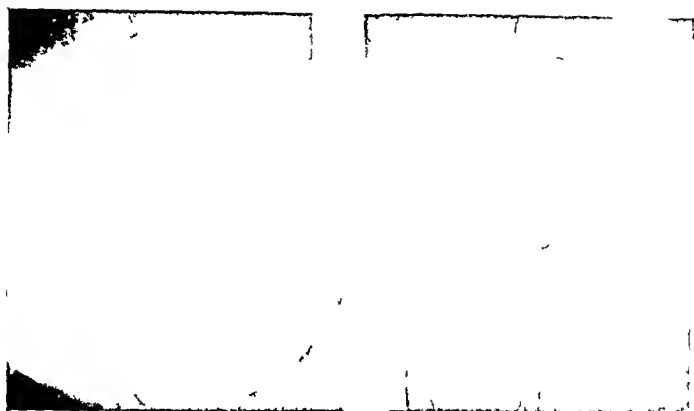
"My brother's health is excellent, he has an artificial limb and walks splendidly"

Specimen was examined by Dr J H Wright, whose report reads

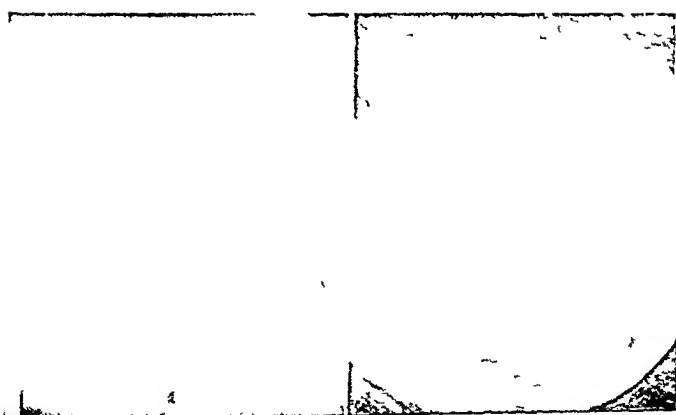
"Specimen consists of the lower half of the femur and some other adjacent parts. In the epiphysis is an irregular-shaped cavity of about the total volume of a small hen's egg. Partially bounding this cavity is a layer of white fibrous-like tissue 1 or more cm thick in places, and attached to the cortical bone, and to the bone underlying the joint surface. At the upper extremity of the cavity and replacing the marrow of the shaft of the bone for a length of 3 or 4 cm is a red, moderately firm tissue. This tissue is rather sharply demarcated from the layer of white fibrous-like tissue above described. Microscopical examination of sections from this red tissue shows a typical giant-cell sarcoma"

At almost the same time, another patient of about the same age, with exactly the same type of tumor, also in the right leg, came under my care.

CASE V—*Central sarcoma of the femur, giant-celled type*—G H S, male, aged forty-seven years, resident of Detroit, Michigan. Family history negative. Personal history: three years before in the beginning of 1908, had fallen upon the ice injuring the lower end of the right femur. An X-ray was taken, and the bone was said to have been cracked. The condition was called by the surgeon a dislocation of the knee. One year later he had another fall, again the knee was said to have been dislocated. In February, 1910, he had a third fall, injuring the same knee. The swelling which had appeared shortly after the first injury had never subsided, and after the third injury began to increase rapidly in size. The series of X-rays taken within the preceding six months showed marked diminution in density of the lower three inches of the right femur and expansion of



Interval 3 months—December 1910-February 1911 Central sarcoma of femur controlled by toxins for nearly one year and text (Case V)



Interval 1 month—February, 1911-March, 1911 (Case V)

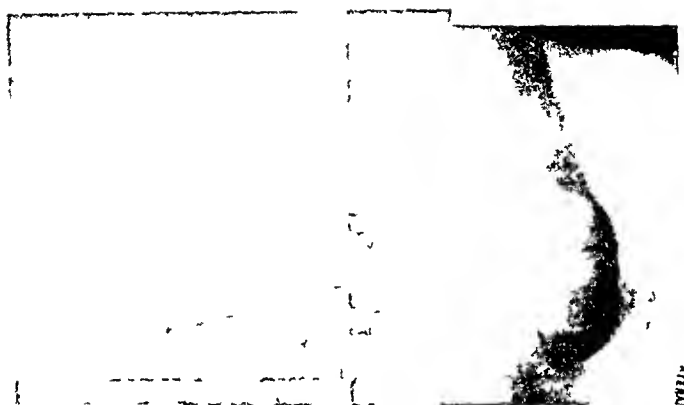


Figure 1. (a) - February 1911-June 1911 (Case V)

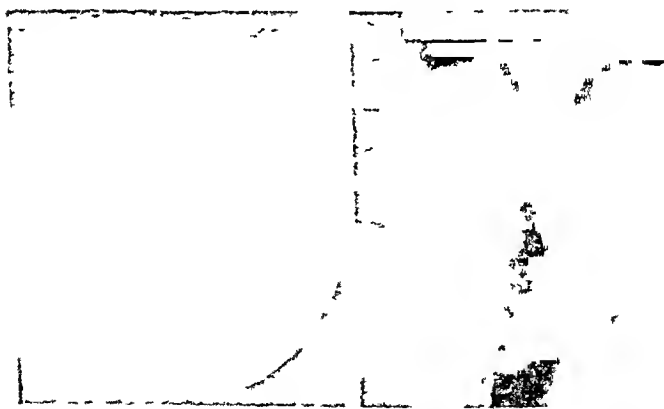


Figure 1. (b) - February 1911-March 1912  
(Case V)



at any time I had seen him, his weight had increased from 192 pounds in February, 1911, to 219 pounds. At this time the discharge had become very much diminished. The X-ray photograph taken the day before showed apparent diminution in size of the tumor with replacement of new bone, no extension of the disease could be made out in any direction, ability to use the leg better than before, general health perfect. The toxins were kept up in moderate doses, with occasional intervals of rest. In February, 1912, suddenly, while walking without any unusual exertion, spontaneous fracture occurred, with very profuse extravasation of blood into the surrounding soft parts, requiring almost immediate amputation. The patient recovered from the operation.

It might be concluded from these two cases that the use of the toxins preliminary to the amputation was an unwise procedure. Yet before forming an opinion one should consider the fact that there are now on record a comparatively large number of cases of sarcoma of the long bones, in which the use of the toxins has not only saved the life of the patient but the limb as well. I myself have had 9 patients, 4 of which I showed before the Clinical Congress of Surgeons of North America, November 14, 1912, well from five to fourteen years.

I believe had it not been for the exploratory incision and the consequent infection, that in all probability the sarcomatous disease would have been entirely controlled by the toxins, and the leg thereby, in one case at least, saved from an amputation. The X-ray photograph and subsequent operation by Dr. Porter in one case showed little if any increase in the size of the tumor during the year or more in which the toxins were used, and the general health of the patients remained perfect. Had the toxins not been used at all, amputation would have been performed  $1\frac{1}{2}$  years earlier. I feel that had one been satisfied in these two cases with the probable diagnosis, instead of insisting upon an exploratory operation and microscopical examination, the patients' welfare, which should always be the primary consideration, would doubtless have been better served. Were I

again called upon, in a similar case, to decide the question of an exploratory operation, I am inclined to believe that I would not advise an exploration in a sarcoma so deeply situated and so difficult of access, in view of the dangers just described. I would trust to the clinical diagnosis confirmed by the X-ray examination and try the toxins for a brief period before amputation, and if no improvement was noted at the end of two to three weeks then decide upon an amputation or resection.

As a general rule I would not amputate a limb for sarcoma unless the clinical diagnosis had previously been confirmed by exploratory operation and a microscopical examination. Yet, there are important exceptions to this rule. I have amputated an arm at the shoulder-joint without any exploratory operation for a tumor the size of a closed fist, that had developed in three weeks. The dilated veins, general appearance and consistence of the tumor made me certain of the diagnosis. I have also amputated the leg for a very large sarcoma of the tibia and fibula, again, for a large sarcoma of the fibula. In addition I have twice performed total excision of the clavicle for sarcoma without previous microscopical examination to confirm the diagnosis. In all of these instances, the very rapid development of the tumor after trauma (within three weeks in three instances) and the clinical features characteristic of sarcoma, made the diagnosis absolutely clear. In these cases the dangers and disadvantages far outweighed the advantages of an exploratory operation, and justified immediate amputation without a microscopical diagnosis.

(4) Still another objection, and a very strong one, is that the tissues removed at the exploratory operation may not represent the typical structure of the tumor and, therefore lead to a negative report on the part of the pathologists. The incision may not have been sufficiently deep and the portion removed may show evidence only of osteitis or productive inflammation, and the pathologist must give a negative report. In the face of such negative report, the surgeon feels it difficult

to determine the best course of action. The situation is well illustrated by the following case recently observed by the writer.

CASE VI—Mrs G M, twenty-seven years of age, in May, 1912, first noticed pain in leg, which was treated for rheumatism for two months, without improvement. There was 14 pounds loss in weight. An X-ray was taken and on basis of same a diagnosis of periosteal sarcoma was made and immediate amputation was strongly urged, without any further examination. The patient was two months' pregnant, and in preparing for the amputation the uterus was emptied. Her husband was told that there was no possible alternative to amputation. The patient was referred to me on September 19, 1912. Examination at this time showed a hard, fusiform enlargement 7 by 8 inches in length, apparently of bony origin in the upper and middle thirds of the femur, gradually shading off into the normal outline of the bone. Largest circumference  $19\frac{1}{2}$  inches, skin normal; no enlarged veins.

The patient entered the General Memorial Hospital and was put upon the mixed toxins. Wassermann examination of the blood proved negative. At the end of a week I made an exploratory incision in about the middle of the tumor, and on cutting down found a fusiform enlargement of the femur of the consistence of a periosteal sarcoma. The tumor extended about  $\frac{1}{2}$  inch beyond the normal line of the bone. A wedge-shaped portion was removed, there was no trace of any inflammatory exudate and no infiltration of the surrounding tissues. Clinically it had the typical appearance of a periosteal sarcoma, originating in the shaft of the bone, and the consistence and gross appearance of the specimen confirmed this view. The specimen was sent to Dr Ewing, who reported as follows:

September 29, 1912. The tissue shows very little if any specific process and does not permit of a diagnosis. There is infiltration of the vessels with large round cells, suggesting sarcoma, but which might very well be

I ought not to express any opinion on the data not amputate without further information

the hospital, the measurements over the upper, part of the cicatrix, representing the upper, and of the original tumor, were as follows

Periosteal sarcoma of femur (clinical diagnosis), 2 months later (Case VI)



Sarcoma of femur mistaken for osteomyelitis      Death from lung  
metastasis three months later





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*a*

\_\_\_\_\_

*b*

*a* bone cyst of tibia, *b* normal tibia (C. C. A. D. C.)

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Periosteal sarcoma of femur (C. C. A. D. C.)

Figure 1



Figure 1 (continued) Without preliminary mi-  
croscopic examination (Case XI)

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Figure 2 (continued) Exposure of object  
(Case XII)

Right, 16 in ,  $18\frac{1}{2}$  in ,  $19\frac{1}{2}$  in Left,  $15\frac{1}{2}$  in ,  $17\frac{1}{2}$  in ,  $18\frac{1}{4}$  in

November 7, right,  $14\frac{1}{2}$  in ,  $16\frac{1}{2}$  in ,  $17\frac{3}{4}$  in Left,  $14\frac{1}{2}$  in ,  $16\frac{3}{4}$  in , 18 in

November 26, right,  $14\frac{3}{4}$  in ,  $16\frac{3}{4}$  in ,  $18\frac{1}{4}$  in

The toxins were continued four to five times a week and the dose gradually increased from 0.5 minim to 6 minims. At the end of two weeks there was marked diminution in the circumference of the thigh. In view of the lack of certainty of Dr Ewing's diagnosis and the rapid improvement under the toxin treatment, it was deemed very important to make a second exploratory incision, and on November 1 I made another incision  $\frac{1}{2}$  inch away from the first, 5 inches in length, and cut down upon the tumor. The latter was found considerably smaller in size, projecting only about  $\frac{1}{4}$  inch from the shaft of the bone. An opening was chiseled into the central portion of the bone and several pieces of periosteal as well as central growth were removed and sent to Dr Ewing. Clinically the tumor had every appearance of a partially necrotic sarcoma, a condition frequently seen as a result of the use of the toxins. Three X-ray photographs have been taken since by Drs L. G. Cole and Holding, who believed the condition to be periosteal sarcoma. Dr Ewing's report of the last specimen, dated November 1, 1912, reads:

Five sections from five different parts of the tissue received fail to show any signs of sarcoma. There is suppurative inflammation in an area lined with granulation tissue. The periosteum and bone show an active productive and rarefying osteitis. I find no signs of syphilis or tubercle. The condition suggests to me a pyogenic infection of the periosteum or osteomyelitis.

The clinical history and macroscopic appearance at the time of operation make it impossible to regard it as an osteomyelitis.

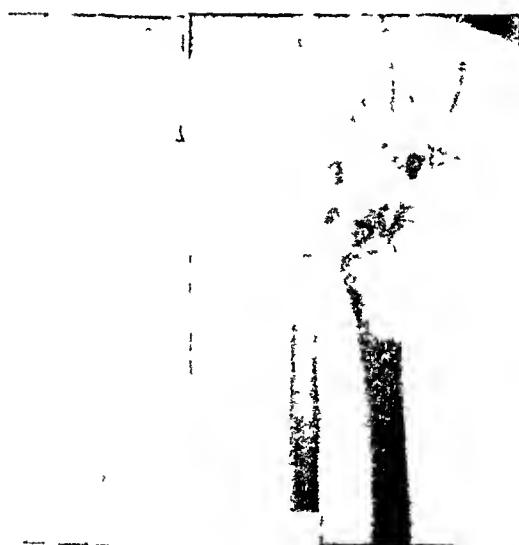
*Subsequent History*—The tumor slowly subsided under the toxin treatment and at the end of six weeks the circumference of the thigh became nearly normal. The patient has had the toxin continued at home for the reason I did not believe it wise to place too implicit faith in a negative pathological report from small portions of material removed at an exploratory operation. She has gained 10 pounds in weight.

January 6, 1912, examination shows the tumor has been re-



radiation proctid (Case XV)

Sarcoma of radius amputation 8 years ago  
Toxin treatment after operation Permanent  
cure (Case XVI)





creasing in size the last three weeks, but the general health is still good I still believe the condition to be periosteal sarcoma

NOTE—February 16, 1913 Under larger and more frequent doses of the toxins the tumor is again decreasing in size

Though we may never know the exact nature of the tumor in question, the conditions show very clearly the difficulties of diagnosis as well as of treatment This case might be cited to prove the wisdom of not amputating a limb for sarcoma except the diagnosis be established beyond question

On the other hand the case (Case II) that furnished the inspiration for the present paper, already described at length, might be said to prove the opposite contention, viz, that it would be wiser to operate on the clinical diagnosis alone, even in the face of a negative report of the pathologist In said case we have a tumor of the femur of 2½ years' duration, pronounced by a number of experienced clinicians as positively sarcoma, and an equal number of X-ray experts confirm this diagnosis Believing it a possible case of myositis ossificans, I advised an exploratory operation, reserving the method of treatment to be decided by the result of the microscopical examination The macroscopical appearance of the material removed was perfectly characteristic of new bone, in no way resembling sarcoma The report of the pathologist was myositis ossificans, no trace of sarcoma Two and a half years later, as shown by the history given, there seemed to be a slight increase in the size of the original tumor, which was confirmed by the X-ray A second exploratory operation was determined upon and a much more extensive removal of the growth was made for microscopical examination Again the structures showed myositis ossificans, and again on the strength of the report I refrained from a more radical operation, which later events proved would have been the wiser plan

There are two theories which may be advanced in explanation of this most obscure case First, that we were dealing with an original traumatic myositis ossificans which, after several years, degenerated and changed into an osteosarcoma.

In support of this theory may be cited the well-known fact that not infrequently benign tumors of the breast, cysts, cystadenomas or fibromas, do undergo malignant degeneration and become carcinoma. Likewise do chronic inflammatory conditions often undergo similar degeneration in course of time. Old fractures offer favorable sites for the development of sarcomata.

The second view is that soon after the accident a sarcoma developed in the bruised and strained portion of the periosteum, the sarcoma remaining of very slow growth and almost latent for nearly six years, and then suddenly, and possibly aggravated by the trauma of the second exploratory operation, lighted up and grew with great rapidity.

Dr. Ewing accepts the latter view as the true one, and believes that the careful microscopical examination gives evidence of its correctness.

I incline to believe the first view, namely, that the sarcoma was of comparatively recent origin, developing from the site of an old myositis ossificans, to be more in accord with the clinical history and known facts. If the tumor was sarcoma from the first, then it was sarcoma at the time of my first exploratory operation, nearly three years later. The specimen removed was not superficial, but extended down fully an inch into the growth and was carefully removed with a chisel. Clinically it had every appearance of new bone, it was absolutely unlike sarcomatous tissue. Microscopical examination by Dr. Ewing himself failed to show any trace of sarcoma. Again,  $2\frac{1}{2}$  years later, the clinical appearance was the same, except for the very slight increase in size. The second exploration was far more extensive than the first, and a large amount of the growth covering an area of 3 inches in circumference and  $1\frac{1}{2}$  inches in depth was chiseled and cut away. This material was macroscopically precisely the same as at the first operation, and was again regarded as myositis ossificans by Dr. Ewing. It is true, there were some cells of peculiar type found at the second operation which he could not fully explain, and which in the light of later evidence were probably cells beginning to undergo sarcomatous



changes The complete and rapid change in the clinical appearance of the tumor two months later would seem to show a corresponding change in its real nature This was further confirmed by the microscopical examination of the tissues removed at this time

If we accept Dr Ewing's view, and his opinion is entitled to more weight than my own, we are forced to the unwelcome conclusion that we can place very little reliance upon the pathologist's report of a specimen removed by an exploratory operation in tumors of the long bones

In my first case, the negative report of the pathologist saved the patient from an amputation which otherwise would have been performed In the second case, the negative report prevented an amputation which would otherwise have been done three years ago, with a greater prospect of saving the life of the patient No matter how we interpret these two cases, we are forced to conclude that the diagnosis of tumors of the long bones is extremely difficult and in certain cases, though happily rare, it may be impossible, even with the advantage of every known aid, to make a diagnosis early enough to save the life of the patient

The only type of sarcoma which could simulate the condition found on amputation, is the type designated by Gross as osteoid sarcoma, and it must be admitted that there is some similarity He describes one case in which the ossified portion of the growth proved a huge mass which looked like spongy bone, and another, in which the appearance was that of dense ivory-like bone Yet, the history of these very cases cited by Gross, makes it difficult to accept Ewing's theory that the case in question was sarcoma from the beginning Gross collected 45 cases of the osteoid type of sarcoma, and from a study of these cases, he concludes that "not only are osteoid sarcomas locally infectious, but they are next to the pure periosteal spindle-celled, the most malignant of all the neoplasms of the osseous system, since 65 62 per cent of all cases died of metastasis" In other words, this type of tumor is extremely malignant, and that means a short duration of

life In fact, in the seven cases which ended in death, without surgical interference, the average duration of life was 16 months, so that it would seem extremely improbable that the tumor in my own case—which had existed for nearly six years before it began to affect the general health of the patient—should have been of this type Furthermore, in my own experience, based upon a personal observation of 125 cases of sarcoma of the long bones, I have never seen a case of six years' duration, or even three years' duration, without operation

MYOSITIS OSSIFICANS—There are three well-recognized types of myositis ossificans which have been described from time to time and which have been receiving more and more attention since the introduction of the X-ray made it possible to study them more accurately

The first type, known as myositis ossificans progressiva, goes on involving one muscle or group of muscles after another until all the muscles of the body are involved It usually starts in the trapezius muscle or latissimus dorsi

The second type is single instead of multiple, and is the result of some chronic irritation or of a series of traumas, instead of a single trauma, well illustrated by the simple osseous formation that occurs in certain muscles so situated as to be liable to irritation or injury, *e g*, the pectoral muscle in soldiers, as a result of the kicking of the musket (Hassen found 18 osteomas in 600 conscripts) Again, this type is found in the muscles of the calf of the leg in cavalrymen and the heel of dancers.

The third and rarer variety is the one with which we are dealing in the present paper, and one seldom recognized before the admirable papers of Binnie (*ANNALS OF SURG*, Sept, 1903) and Robert Jones (*Arch of the Rontgen Ray and Allied Phenomena*, 1905-1906) Binnie reported a most interesting personal case and collected all the other cases he was able to find in the literature up to that time Cahier (*Rev de Chir*, 1904) collected 257 cases of myositis ossificans

traumatica, including the second and third varieties, but not the progressive type

Most statistics, up to the time of Strauss, grouped together, under the general head of myositis ossificans traumatica three or four different conditions. The term should properly apply only to those resulting from a single trauma. It is interesting to know that Strauss collected 127 such cases. Of these 43 occurred in the quadriceps femoris, 13 in the adductors of the thigh, 64 in the flexors of the upper arm, the remainder were scattered over various muscles of the body. The best papers in recent years are that of Finney (*Transaction of the Southern Surgical Society*, 1909), and that of Lapointe (*Revue de Chirurgie*, Nov., 1912)

Finney reported six cases, three observed by himself, three others seen in consultation, four occurred in football players, one came to operation, all recovered

To emphasize the point which I shall discuss more fully later, that the disease may closely simulate sarcoma, it is stated that the diagnosis of subperiosteal sarcoma had been made in all three of Finney's cases. One case, operated upon twice, recurred, necessitating three operations. Amputation at the hip-joint had been recommended and was about to be performed in one case, when first seen by Finney. In another case quoted by Finney (Whitelock) amputation of the thigh was performed under the mistaken idea that the condition was a periosteal sarcoma

Finney states that males are almost invariably the subjects of this affection, only two cases in woman having been thus far reported. This is probably explained by the fact that men are much more liable to severe injuries, which are the exciting causes. The disease is much more common since the introduction of football. Of Finney's cases two were due to the kick of a horse, four to injuries received while playing football

The most recent and elaborate study of the pathology and treatment of myositis ossificans, or "myostéomes traumatiques" as the French characterizes the disease, is that of

Lapointe, published in the *Rev de Chir*, in November, 1912. Lapointe reports one case of his own, of the quadriceps extensor, very closely resembling my own cases and that of Mr Makins. This case occurred in a man twenty-one years of age who attributed the trouble to a fall three weeks before. A tumor apparently springing from the anterior and middle portion of the femur, 17 cm in length, had developed within the short period of 24 days after the injury. Extension was normal, flexion markedly limited. An interesting feature which I have not noted in other cases, was a temperature of  $99^{\circ}$ – $100^{\circ}$ . Lapointe states that he made a grave error in diagnosis. The very close fusion with the diaphysis of the femur, the slight dilatation of the superficial veins, the temperature, all seemed typical of a periosteal sarcoma. The radiograph which should have corrected the error only emphasized it by reason of the use of an imperfect plate. The radiographer took a second plate which gave an identical result. Before proposing to the patient such a mutilating operation as amputation at the hip-joint, he decided to wait a short time. In 15 days the supposed sarcoma, instead of increasing in size, had diminished. Another radiograph, taken a month later, showed the same characteristic appearance of myositis ossificans as I have observed in my own cases. Lapointe operated on May 26, 1911, 66 days after the injury, and removed an elliptiform tumor  $17 \times 5 \times 3$  cm. Muscular fibres completely surrounded it except at its point of attachment to the femur over an area 6 cm long and 2 cm broad. A fragment of periosteum detached from the femur adhered to the internal aspect of the osteoma. The patient made a good recovery, but had a slight recurrence four months later.

Robert Jones, in 1905, gave a brief history of 15 cases of the third variety personally observed, and a résumé of most of the cases collected by Cahier and Binnie. Most of Jones's cases occurred in the vicinity of joints. In only two of Jones's cases was there a microscopical examination made and the pathologist's report (Dr Dimond, hospital pathologist) reads as follows. "In the first case the bone generally is of

the cancellous type and at the edge of the bone the muscle seems to have been sprinkled with numerous small foci, around which the bony matter has been deposited, generally the centre of these foci contains a small branched cell (osteoblast) The bony matter is deposited along the muscle-fibres and at parts of the specimen the striation of the muscle is still visible The condition is a true ossification, not calcification "

In the second case he reports " The general shape of the bone was that of a V There were no signs of any periosteum whatsoever There were numerous foramina over the whole bone, into many of which passed small tendinous extensions from the surrounding muscle, and into others passed small blood-vessels which communicated directly with the cancellous spaces throughout the mass of bone The general structure was that of soft or cancellous bone, the spaces being fairly large and occupied by blood-corpuscles and a few giant-cells, etc "

These two cases show a structure strikingly similar, both macroscopically and microscopically, to that observed in my own two cases The clinical history in Jones's and the collected cases was much the same We have the history of an antecedent blow or injury and the subsequent development of a hard tumor a few weeks or months, or in some cases years, thereafter

In none of the cases thus far reported has there been a history of transformation or degeneration of the bony tumor into a sarcoma or malignant growth Yet it would be impossible to state that such a result never occurred in these cases, inasmuch as they are nearly all lacking in the very important detail of after-history Makins' two cases published in the *Transactions of the Royal Soc of Med*, Surg Section, 1911, are an important exception In both cases an X-ray was shown of the original condition and the condition six years later

*Etiology*—The question of the etiology of traumatic myositis ossificans has already been fully discussed by Binnie

the femur, with a sharply outlined, tumor-like formation, projecting about an inch beyond the normal outline of the bone. The tumor occupied chiefly the posterior or popliteal region of the femur, although the bone was enlarged in all directions, the joint was not involved. Various diagnoses had been made by a number of leading surgeons and X-ray experts. Nearly every one had given a different diagnosis. One of the most prominent surgeons of Chicago, who had seen it, believed it to be a cyst of the bone, non-malignant; another believed it malignant and advised amputation. My own diagnosis was, that it was unquestionably a sarcoma of central origin, probably giant-celled. On February 23, under ether anæsthesia, an incision six inches long was made over the inner condyle of the right femur, cutting down to the periosteum, pushing the vessels to one side in order to explore the popliteal region. A tumor about the size of a goose egg, apparently situated beneath the periosteum, was found. On opening this and passing through a thin shell of bone, a mass of partly broken-down, soft material was encountered, reddish-gray in color, and having the appearance of a vascular sarcoma; the finger passed into the cavity of the bone, the joint was not involved. Here again there was severe hemorrhage which it was found difficult to control. It was finally stopped by packing, as in the preceding case. Microscopical examination showed the tumor to be a sarcoma of the giant-celled type. The patient was immediately put upon the mixed toxins and remained under my care for two months, after which the treatment was carried out by Dr. J. W. Vaughan, of Detroit. The patient proved to be extremely susceptible to the toxins and was unable to take more than 3-4 minims, which were followed by severe reactions, the temperature rising in some instances, to  $105^{\circ}$ - $106^{\circ}$ . At the end of four months' treatment his susceptibility had increased instead of diminished and he was unable to take more than 1-2 minims.

In this case, as in the preceding, a series of X-ray examinations were made every four or five weeks, and these were carefully compared with the pictures taken before the operation. Physical examination July 27, 1911, showed much less discharge from the sinus, which has persisted since the operation. Measurements over the middle of the patella showed a decrease of one inch, from  $18\frac{1}{2}$  before operation to  $17\frac{1}{2}$  now. January 5, 1912, I again examined the patient, and found his condition better than

growth springs from the periosteum. He bases his conclusions "largely upon the frequency with which these growths are associated with dislocation, their frequent attachment to bone, their frequent growth between the bone and muscle, and sometimes their attachment below the muscle origin, which has been subjected to a violent strain, that in fractures shreds of periosteum may give rise to the development of bone apart from the callus and reparative processes." Jones states that in nine-tenths of the cases the tumor formation is marked in the first two months, the majority by the end of the first month. The recent researches of Macewen upon the growth of bone give rise to some doubt as to the periosteum's being the sole cause of the new bone.

After a very full discussion of the various theories as to the etiology of myositis ossificans, Lapointe states that in his opinion "the theory of an ossifying myosteoma is tenable both for the adhering myosteomas and for the free ones. It can be seen that the insertion into the skeleton is the only point which distinguishes them. All of their other characteristics, both microscopical and macroscopical, are the same. No difference in the method of their development or in their structure has ever been found. The cartilaginous ossificans that has been considered as a type of periosteal osteogenesis is found also in the medullary osteogenesis, so, why should we maintain that the tendinous insertion of a muscle, which is an incontestable factor in the formation of free myosteomas, has not to do with the formation of adherent myosteomas? Is the implantation or non-implantation enough to justify two different pathogenic theories?"

Gillet, in his Thesis of Paris (1910), discusses at some length the difference between myosteomas (myositis ossificans) and true neoplasms. He states the fact that the former not infrequently recur does not constitute them neoplasms, although some writers take the opposite view. A true neoplasm is capable of not only local return but of general metastases, a quality which the tumor in myositis ossificans

does not possess, there being no case on record so far of other than a local return

He believes that whatever the anatomical considerations clinically osteomas should never be classed as tumors, and states that, in the first place, we are able to reassure the patient and his family as regards any fears of a tumor. Whatever the variety of osteoma, it is always benign without tendency to increase indefinitely or to generalize, and never is transformed into a malignant process

This statement of Gillet's was probably true at the time it was written, though the evidence here presented may lead to some qualification in the future

*Diagnosis*.—Various conditions may simulate myositis ossificans, particularly in the early stages, *e g*, contusion, hæmatoma, myositis, periostitis, periarthritis syphilitic tumors, but all of these conditions can be differentiated by means of a careful examination aided with a good radiograph

In periostitis and osteomyelitis, we usually have elevation of temperature, local tenderness, severe pain which is worse at night. Myositis is prone to develop in certain muscles which are seldom the site of syphilitic disease, and the Wassermann test will furnish an additional aid in differentiating the conditions

On the other hand, the age of the patients (usually young adults) and the fact that the tumor developed shortly after an injury furnish a history almost identical to that observed in sarcoma. In many cases, too, there is a striking similarity in the X-ray picture between the two diseases. In my first case, the X-ray plates had been examined by at least half a dozen X-ray experts and all pronounced the lesion sarcoma. Careful examination, however, of the radiographs which I have been able to observe personally shows this important difference

In myositis ossificans the sharp outline, corresponding to the junction of the tumor with the bone, is always present while in sarcoma it is less distinct except in the very early stages of the disease. It was this feature which influenced



chiefly in making the diagnosis of myositis ossificans in the first case. In the second case the same clear line of differentiation is observed in the earlier picture, although it is not so distinct in the later. I have seen but one case of periosteal sarcoma in which this was not true, and this happened to be a case of extremely rapid growth, apparently sarcoma, in a young adult, a woman of nineteen. The X-ray photograph taken about a month after the beginning of the tumor showed a clear line without any roughness or indentations, which could easily be mistaken for myositis ossificans. In this case, however, there was the absence of a severe injury which is almost always the exciting cause in myositis ossificans, which furnished an important aid in making the diagnosis.

A further and very important point which I have not seen noted in other articles is the marked difference in the consistence of the tumors as determined by palpation. In myositis ossificans the consistence is much harder than in sarcoma, furthermore, it is almost always uniform in character, whereas in sarcoma it is very apt to be soft in some places and harder in others, but there is never the bony hardness that is typical of myositis ossificans.

The pain is another important differential symptom. In sarcoma there is rarely pain in the early stages, unless the tumor is situated near some important nerve, whereas in myositis ossificans pain is much more apt to be a feature in the early development of the disease. Furthermore, the early disability of the neighboring joint, as usually observed in myositis ossificans, has been seldom noted in sarcoma in the early stages. Flexion of the knee is almost lost or greatly limited, and this may occur very soon, a few days after the injury, in myositis ossificans.

The clinical history together with the characteristic features already enumerated will, in most cases, enable one to render a correct diagnosis of myositis ossificans, yet the great importance of making an early and absolutely certain differentiation from sarcoma, in my own opinion, justifies an early exploratory operation and removal of sufficient ma-

terial for a microscopical examination. This is especially true if the tumor is located along the shaft of the bone and not in the neighborhood of a joint. In case the patient is unwilling to submit to an exploratory operation, very careful and frequent observations will soon determine the true character of the disease. If it is sarcoma, there will be steady and fairly rapid increase in size, if myositis ossificans, but very slow increase in size, if any, is noted.

*Treatment*—The question of treatment is an extremely important one. Yet the data at the present time would seem hardly sufficient to warrant the laying down of any absolute rule. Jones states that "if we operate early, we risk leaving histological elements behind. If we operate late, apart from the greater destruction of tissue, the proceeding is sometimes very difficult. With our limited experience we would suggest early operation, feeling it would be wiser to risk the performance of a second operation in an endeavor to prevent the spread of trouble, than to delay operative interference, which might result in exuberant development of bone."

Jones, however, in a letter to Mr. Godlee (*Trans. Royal Soc. of Med., Surg. Section*, 1911), admits that further experience led him to considerably modify his original opinion as regards treatment. In this letter he states: "Since writing the article I have come upon cases where the deposits, instead of increasing, have decreased, and I am not now at all convinced of the value of operation. The simplest looking mass in the bend of the elbow is a very difficult problem to negotiate operatively, and I have on more than one occasion wished I had left the whole thing alone."

A careful review of the cases thus far recorded would lead one to conclude that no single method of treatment is applicable to all cases. The two very interesting and most typical cases, carefully reported by Makins (*Trans. Royal Soc. of Med.*, 1911, p. 132) furnish further strong ground for first trying conservative treatment. These two cases, as shown by the history and radiographs, are almost identical with my first case. Makins's cases were both young adults,

in both the disease occurred in the quadriceps muscle, one followed a football injury, the other the kick of a horse. In both cases he was able to show radiographs taken six years after the original injury, demonstrating almost complete resorption of the bony tumor.

With regard to treatment, Makins states. "As to the general line of treatment to be adopted, a period of some weeks' complete rest should be maintained during the continuance of the active progress of ossification. When it is judged by clinical observation and X-ray examination that progress has ceased, or the process is retrogressive, massage and exercise should follow. Operative treatment should only be considered when the process has manifestly come to a definite standstill, and the patient suffers from functional disability which there is a chance of relieving."

Godlee's case (*lc*) still further shows the advantages of conservative treatment. Godlee stated that Mr Clutton operated upon two similar cases in which the operation had done harm, and he strongly urges "the advisability of leaving these swellings alone until ample time has been allowed, at least a year for the absorption of what may be called provisional callus. Even after this time, I think that removal would only be justified if the mass were causing mechanical inconvenience and pain. It must be remembered that the operation is inflicting another traumatism upon a part, which for some reason has shown a special tendency to the development of bone, and it cannot therefore be surprising if renewed activity of the process should follow."

Some advise early incision and evacuation of the extravasated blood, but this is of doubtful expediency and not to be recommended. Massage is, likewise, inadvisable.

Finney has this to say as regards treatment. "There is an unfavorable as well as a favorable time for operation. It should never be recommended early in the development of the bony tumor, even for diagnostic purposes, since, if we have to deal with a subperiosteal sarcoma, it is of doubtful efficacy, and in this condition the tendency to recur at this stage is very great. If the operation is performed when increase in the size

of the tumor is no longer present and its consistency has become harder, the chances of a recurrence are very materially lessened. The operation should consist in a thorough excision with ample margin of all the osteoid tissue, including some healthy muscle. The underlying periosteum should be thoroughly excised and the shaft of the bone cleaned off until a smooth surface remains. Cauterization with the actual cautery of the denuded bone surface has been recommended. Operation is not recommended in every case, many of them recover under rest and later massage and active and passive motion."

I cannot agree with Finney in advising against exploratory operation for diagnostic purposes. He states that, if we have to deal with a subperiosteal sarcoma, it is of doubtful efficacy. This advice is evidently based on the generally accepted belief that subperiosteal sarcoma is an entirely hopeless condition. Yet we now have a rapidly increasing number of cases of subperiosteal sarcoma which have been cured (and are well over three years) either by the mixed toxins of erysipelas and *Bacillus prodigiosus*, alone, or by the toxins combined with operative treatment. One such case I have the pleasure of showing this evening. This case, a round-celled subperiosteal sarcoma of the femur with extensive multiple metastases, recovered under the toxins and remained well over ten years. A full report of this case will appear in a later number of the ANNALS OF SURGERY. Another important case in point is the case of Williamson (*Transactions of N. Dakota Med. Soc.*, 1910), periosteal round-celled sarcoma, confirmed by microscopical examination by the pathologist of the State Laboratory, and pronounced too far advanced for hip-joint amputation by Dr. W. J. Mayo, who advised the mixed toxins. The patient entirely recovered, with a normally useful leg, and is now well 3½ years later. I do not believe that the small exploratory incision with removal of sufficient material for diagnosis, does any harm in either condition in ordinary cases, and may be of the greatest value in enabling the surgeon to at once advise the proper method of treatment.

In laying down any general rules for the treatment of myositis ossificans, I believe with Lapointe, that sharp distinction should be drawn between the two classes of myositis ossificans, *i e*, the cases occurring along the diaphysis of the bone and those situated in the neighborhood of a joint. The latter cases are often complicated with ossifying periarthrititis which greatly affects the operative prognosis. While in a number of the cases recorded in the literature there has been a true recurrence after operation, in no case has the size of the recurrence reached that of the original tumor. Lapointe was able to find only 2 cases that had been re-operated upon after recurrence, the cases of Hoffmann (*D Militär-ärzt' Zeitschr*, 1902, vol xxxi) and Patry (*Soc méd de Genève*, 28 janvier, 1909). In the case of Patry there were three successive operations at intervals of a few weeks. The third recurrence was not operated upon, but finally disappeared and the patient fully recovered the function of the extremity.

The thesis of Chabrol (*Contribution a l'étude des ostéomes musculaires, etc*, *Thèse de Paris*, juillet, 1912) gives the latest facts bearing upon the end results of operation. In 95 cases which he collected there was complete restoration of function in 77, improvement was noted in 15, and no improvement in 3 cases.

In the cases in which the lesion occurred in the neighborhood of a joint, in which there was more or less coexistent ossifying periarthrititis, the results were not as good. Chabrol found 25 cases of extirpation of the anterior brachial muscle after dislocation, with complete restoration of function in 8, improvement in 8, and no improvement in 9.

Lapointe's conclusions as regards treatment are that prophylactic measures are uncertain, the value of conservative treatment is more apparent than real and explains the spontaneous regression of the ossifying process which, in time, often results in complete restoration of function. He believes that extirpation six or eight weeks after the trauma is the method of choice in cases not complicated with ossifying

periarthritis In some of these, the more severe cases, resection may be advisable

NOTE—I desire to express my great indebtedness to Dr Byron C Darling, not only for his very excellent radiographs but also for his valuable help in preparing and arranging the illustrations

I further wish to express my appreciation of Dr James Ewing's hearty cooperation in the matter of pathological reports and microphotographs

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# SUB-TEMPORAL MUSCLE DRAINAGE BY THE AID OF SILVER WIRE DRAINAGE MATS IN CASES OF CONGENITAL HYDROCEPHALUS

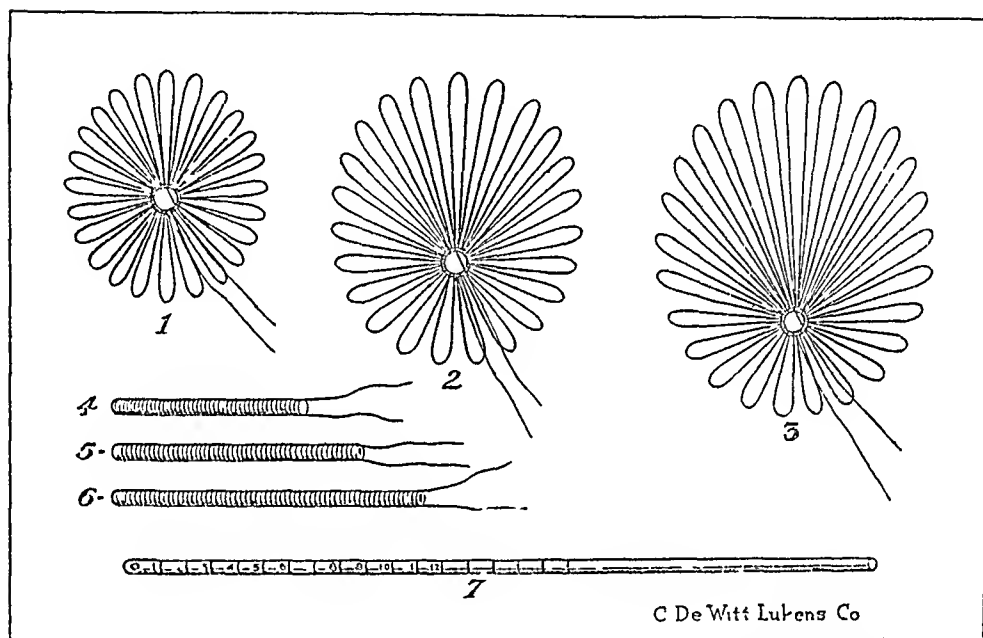
BY WILLIAM H HUDSON, M D

OF ATLANTA, GA

IN cases of congenital hydrocephalus where drainage underneath the scalp is attempted the writer has found a vast additional drainage capacity by using the under surface of the temporal muscle for the absorption surface by inserting under this muscle silver wire drainage mats. Where this is to be attempted the operation should be done in the following manner. The usual point for perforating the skull dura and brain, posterior and above the right ear is selected. An incision about two and one-half inches long, with its curve in a backward direction, is made down to the temporal muscle. A point about an inch in front of the curved incision is selected, and the fibres of the temporal muscle separated at this point. A flat separator with its point hugging the bone closely is pushed in every direction to its line of insertion under the entire skull area of the temporal muscle. Then the skull is opened with a self-stopping spiral perforator, its bottom cleared with the smallest size self-stopping burr. The dura is then split the full extent of opening in the skull. The two edges of the dura are then caught with mosquito forceps and the incision held open as far as possible. Through this opening a long, dull-pointed ventricular puncturing tube is inserted into the brain until the cerebrospinal fluid flows from its open end. The depth is read off on the side of the tube, which is marked in quarter inches. The permanent drainage tube is then cut to its proper measured length, and then slipped over the puncturing tube and carefully rotated to its proper permanent location in the brain, the two lateral fixation wires being carefully preserved. The silver drainage mat, which was fixed under the temporal muscle immediately after the muscle was separated

from the bone, is now fixed in position, and the fixation wires of the permanent tube carefully twisted around the central ring of the drainage mat. The temporal muscle is then carefully sewed over the mat and tube with the finest possible black silk. The incision in the scalp is also closed with the finest possible black silk. This operation must be done under the strictest aseptic precautions, with the use of new rubber gloves and the most careful sterilization of the patient's scalp.

FIG 1



1, 2, 3, silver wire drainage mats of different sizes. The fixation rings should be shown nearer the edge of the mats. 4, 5, 6, permanent drainage tubes of coiled silver wire of different lengths with fixation wires. 7, brain puncturing tube with dull round end marked in quarter inch lines. The opposite end should be marked in the same manner beginning with 1, so that this end could be used as a measure for the permanent drainage tubes. The puncturing tube should not be removed until the drainage tube is properly placed.

A loose dressing finished with plaster-of-Paris bandages should be applied in such manner that no direct pressure is applied over the operation wound or the temporal region of the operated side. The greatest possible accuracy and delicacy of operative procedure should be observed.

In Fig 1 are shown three sizes of the drainage mats, three lengths of permanent drainage tubes, and one puncturing tube marked at its puncturing end in one-quarter inches. The other end should be marked in the same manner so that that end may be used for measuring the permanent drainage tube before it



is cut The permanent drainage tubes, as shown here, are made of coiled silver wire It is possible they would be better if made of the thinnest gold, or silver, or platinum plate, with the fixation wires soldered to the ends of these tubes Generally it would be necessary to cut them at the time of use Cutting these thin tubes with a pair of scissors makes sharp corners which may cut the cortical vessels when the tubes are inserted So, if solid tubes are used, it is best to cut them with a sterilized file, cutting through the wall of the tube its entire circumference. The tubes made of coiled silver wire can be cut with the point of a pair of scissors without constricting them All that is necessary is to cut the wire at one point after the lateral holding wires have been cut In inserting the mat under the temporal muscle a spooned brain spatula should be pushed well under the temporal muscle If any difficulty is encountered the silver wire loop should be pushed home carefully and accurately with the point of a silver probe which has been notched for this purpose The mats should be placed smoothly under the temporal muscle, being careful that the loops reach well down toward the zygoma

Two small drill holes made on either side of the trephine opening in the skull through which the fixation wires are passed will add somewhat to the stability of the mats and tubes

# THE THYROGENIC ORIGIN OF BASEDOW'S DISEASE.

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IT is now about twenty-five years since Moebius emphasized the importance of the thyroid gland in Basedow's disease and advanced the theory that in the hyper-activity of the gland we find the cause of the symptom-complex which is generally known as Basedow's disease. It was in 1887 that Moebius published his classical treatise upon this subject. The treatment of this disease since that time has for the most part been based upon this hypothesis, and remedies both medical and surgical have been employed which were designed to check the activity and thereby diminish the secretion of the thyroid gland. So general has this hypothesis become that the thyroid origin of Basedow's disease has been practically accepted by the medical profession the world over.

While from a clinical, and we might perhaps say also from an experimental, standpoint the thyroid origin of the symptoms of this disease seems well established, yet there are many problems still to be solved. The primary cause of the thyroid change is as yet unknown, while much confusion and contradictory evidence exists throughout the literature, especially relating to the questions of hyper- and dis-thyroidism as the essential elements in the disease.

Marine and Lenhart<sup>1</sup> have written extensively against the present conception of this disease and endeavored to show, through experimental observations made by themselves as well as the observations of others, that the Moebius theory has never been proved and therefore the present methods of treating Basedow's disease are not based upon a proper foundation. Marine and Lenhart have come to the conclusion that the thyroid changes are not the cause of the symptoms of the disease, but that the involvement of this gland is only a part of a general disease and is therefore only symptomatic, that the

only disturbance of the thyroid in this disease is that of functional insufficiency, while its reaction is only compensatory

Marine of Cleveland, before the Surgical Section of the American Medical Association, at its recent meeting in Atlantic City, again reviewed the experimental evidences for and against the hyperthyroidism theory of Basedow's disease, giving the same conclusions as before, mainly that the hypothesis of Moebius was as yet to be proved

C F Hoover<sup>2</sup> bases his views upon the investigations of Marine and Lenhart, and seriously questions the present surgical treatment of Basedow's disease Hoover is of the opinion that the disease is not of thyrogenic origin, and that the good results obtained from the surgical treatment cannot be explained upon the basis of hyperthyroidism

It is interesting, from a practical surgical standpoint, to note the opinions expressed by those who are opposed to the thyrogenic origin of the disease in explanation of the good results following its surgical treatment, such results are explained as being due to the rest in bed, psychic causes, suggestions, or, as Carlson (3, p 130) says, that they are perhaps "instances of spontaneous recovery"

The arguments usually given for dissenting opinions against the Moebius theory may be grouped as follows

*First*—The unknown factor or cause of the increased activity of the gland

*Second*—The failure of both medical and surgical treatment to cure all cases of Basedow's disease

*Third*—The occasional spontaneous cures which result from other forms of treatment, such as rest, nerve sedatives, etc

*Fourth*—The apparent inability to reproduce the disease experimentally in lower animals

*Fifth*—The refutation and rejection of published experiments in which the disease has been produced in lower animals

*Sixth*—Ascribing the cure to some other factor after surgical treatment rather than to the operation itself, such as the relief of pressure, rest in bed, psychic treatment, etc

It is the purpose of this paper to review the chief clinical

and experimental evidences in favor of the thyroid origin of the symptoms of Basedow's disease as a justification of the present surgical methods in its treatment. It seems to me that sufficient time has now elapsed to have tested the thyroid theory to such an extent, at least from a clinical standpoint, that we particularly as surgeons feel warranted in claiming that in the thyroid gland we find the chief cause of the symptoms of exophthalmic goitre.

#### EXPERIMENTAL HYPER-THYROIDISM AND BASEDOW'S DISEASE

CARLSON,<sup>8</sup> in a most excellent article, reviews the attempts to produce the experimental hyper-thyroidism in animals and birds, and adds some very interesting experiments of his own. His work is particularly directed to the refutation of the theory of hyper-thyroidism. He states that the prevalent view regarding the etiology of exophthalmic goitre is based upon "(1) the structural changes in the thyroids, (2) the effects of partial extirpation of the gland, (3) the aggravation of the symptoms by thyroid administration, (4) and the alleged production of some or all of the symptoms in healthy individuals and experimental animals by thyroid administration."

Regarding the structural changes in the thyroid glands of Basedow's disease, he thinks their significance has been a matter of inference rather than of direct demonstration, as such changes are variable and may signify an *altered* secretion rather than an *excessive* secretion, and seems to agree with Marine that some of the cardinal symptoms of exophthalmic goitre are effects of some disturbance of metabolism and not primarily the direct result of the thyroid changes. He publishes a large number of experiments in the feeding of thyroid extract upon a great variety of animals and also one experiment upon himself. While Carlson was able to produce toxic symptoms and obtain symptoms of loss of body weight, gastro-enteritis, and dysentery, he concludes "It would require considerable imagination or an undue influence of one's wish or one's judgment to identify the symptom-complex of excessive thyroid feeding in experimental animals with the exophthalmic goitre syndrome in man. The symptoms in experimentals may or may not be an expression of hyper-thyroidism. Other lines of investigation must determine that point. The symptoms are not those of exophthalmic goitre."

KLOSE,<sup>4, 5</sup> in his address before the German Surgical Congress of 1911, states that in spite of all the advances that have been made in the investigations of Basedow's disease by Kocher and others we do not know at the present time whether the disease is due to a hyper- or dys-thyroidism, whether the variation from the normal is a quantitative or qualitative one. Klose injected intravenously thyroid pressure fluid, or "press-saft" (taken from fresh Basedow thyroids), in over one hundred animals. He was apparently able to produce typical Basedow's

disease in these animals. The symptoms following the injection were elevation of temperature, irregular pulse, disturbances of respiration, tremor, sweating, and the elimination of albumin and sugar. In rare instances exophthalmus was noticed. The blood-picture showed for a short time an increase in the general amount of leucocytes, especially of the polynuclear cells, but the typical blood-picture of Basedow's disease, or lymphocytosis, soon followed. A marked reduction in the blood-pressure was also noted. The blood-picture following the injection was so characteristic, as compared to the injection of "press-saft" obtained from the ordinary or simple struma, that Klose regards it of value as a differential diagnostic method. Klose found also that the intravenous injection of potassium iodide in dogs gave a very similar reaction. He therefore came to the following conclusions: that Basedow's disease is not a hyper-thyroidism, but rather a dys-thyroidism. The thyroid gland does not have the normal activity for storing up iodothyron, but rather permits it to be carried into the circulation in a form which is as yet unknown, but to which Klose has given the arbitrary name of "Basedowiodine."

BIRCHER, \* in a recent contribution, as well as in his previous article published in the *Bd 1 des 15 Jahrgangs der Ergebnisse der allgemeinen Pathol u pathol Anat*, p 225, reports his endeavors to experimentally reproduce Basedow's disease. In his later experiments he employed implantation of thymus gland into the peritoneal cavity of lower animals. Bircher was led to these experiments by the reports from other authors (Capelle, Thorbecke, Hart, Grecke, Garre), who reported a large number of thymus deaths in cases of Basedow's disease. He therefore came to the conclusion that in Basedow's disease the thymus gland plays an important role, and that its importance in this disease is even as great as that of the thyroid gland itself. He was especially impressed with this thought after looking over the statistics of deaths from Basedow's disease and of its cure by Garre following the operation of thymectomy and also by the production of Basedow's symptoms after the injection of thymus juices. Bircher relates that in five dogs he has produced the whole picture of Basedow's disease in a manner so pronounced as had heretofore never been observed. In these experiments Bircher used pieces of thymus gland which he obtained from patients who did not suffer from Basedow's disease but rather died from persistent thymus gland and narcosis shock or from cases of stenosis of the thorax in which a thymectomy had been performed. The pieces of thymus gland were used in a very fresh state, exposed to the air for only about a half minute, and directly implanted into the peritoneal cavity of dogs. He publishes a photograph of one of these dogs showing the typical picture of Basedow's disease,—i.e., exophthalmus and enlarged thyroid gland. In this dog a piece of thymus gland about one centimetre thick, obtained from a case of endemic Cretinism, was implanted into the omentum. The first symptoms manifested themselves after forty-eight hours. The dog became very irritable and excited and sprang about his cage like one possessed. He took but little nourishment and had an enormous thirst, the exophthalmus showed itself on the fourth and reached its height

after the twentieth day, remained stationary for a few days, and then became less apparent. It did not disappear entirely until after five months. On the third day tachycardia appeared, the pulsations became very rapid, as high as 180, there was also a tremor of the legs and paws, as well as of the whole body. The enlargement of the thyroid gland could still be felt after four or five weeks. At the end of the first week a pronounced lymphocytosis was present, which, however, did not persist. The appetite was greatly diminished, a diet rich in albumin produced glycosuria—no pronounced dysentery. The tachycardia lasted three months, but the enlargement of the thyroid remained after most of the other symptoms disappeared.

Two of these dogs were allowed to live for further study, in the other three the operation of total thyroidectomy was performed. These animals died very rapidly from acute cachexia thyreopriva.

Bircher thinks that these experiments, which for the first time have produced so pronounced and typical an exophthalmus, demonstrate the correctness of the correlation of Basedow's disease with the function of the thymus gland.

BARUCH,<sup>7</sup> in a recent contribution, reviews the work of Bircher as well as his own experiences, now of several years, in the experimental production of Basedow's disease. Baruch states that for such experiments he used ordinary goitres, usually of the parenchymatous variety, or simply the colloid variety. These goitres were prepared freshly a few hours after the operation, ground up very finely so that it could be injected into the animals through a cannula of large calibre. Injections were made either subcutaneously or into the peritoneal cavity, usually the latter. With this method he produced typical Basedow in a large series of dogs as well as in rats and rabbits. After injection the dogs showed unusual irritability and nervousness, decided emaciation, loss of hair and dysentery, tachycardia, glycosuria, lymphocytosis, and, in a few instances, pronounced exophthalmus. Three of such dogs with exophthalmus were demonstrated by Baruch on July 10, 1911, before the Breslau Surgical Association. One of these dogs, as a result of lagophthalmus, developed an ulcer of the cornea. For these experiments he found that very young animals, especially females, were more susceptible. He injected from five to twenty centimetres of the macerated gland, usually extending over a period of eight days. The exophthalmus usually developed on the twelfth or fourteenth day. Baruch claims that in the experiments of Klose the toxic principle of the Basedow thyroid gland is to be found only in very small quantities,—*i. e.*, "press-saft," as used by that investigator. Parallel experiments to those of Klose were made by Baruch in which he used the Basedow thyroid gland instead of the ordinary small forms of goitre, and he found that he could produce the symptoms of the disease much quicker and more often than with the ordinary gland. Baruch believes that the toxic principle does not leave the thyroid gland and enter into the "press-saft." Baruch states that his experiments, as well as those of Bircher, demonstrate the interesting fact that one can reproduce the typical picture of Basedow's disease by the employment

of certain tissue which does not necessarily come from a patient with Basedow's disease

FRENCH<sup>8</sup> undertook to study the comparative toxicity of different tissues in animals susceptible to thyroid feeding, the object being to discover whether the effects of commercial thyroid extract when administered are specific or whether similar effects could be produced by other animal tissues prepared and administered in the same way, "Whether it is due to decomposition products or whether it is due simply to the great amount of proteid matter ingested by an animal unaccustomed to such a diet" His conclusions were as follows

1 Thyroid in the forms used—fresh, stale, and desiccated, either commercial or laboratory prepared—contains a substance that is decidedly toxic for some animals

2 The other animal tissues used—brain, liver, spleen, kidney, and skeletal muscle—give no evidence of toxicity when prepared and fed in the same way in equal or even larger quantities

3 While the study does not indicate the nature of the toxic substance, it would seem to show conclusively that it is not due to protein in the food

*Thymus Gland*—The correlation of the ductless glands of the body in their functional activity has led to many theories regarding the cause of the primary thyroid change in Basedow's disease. The most important ductless gland which experimental and clinical evidences seem to show to be intimately associated with the thyroid is the thymus gland. This gland has been found persistent in severe cases of Basedow's disease and has been experimented with by Bircher in the artificial production of the disease, as already given above, and to it has been ascribed the essential factor in producing the thyroid change. The thymus gland has even been removed for the cure of Basedow's disease, and apparently with good effect

MATTI,<sup>9</sup> in showing the relation of the enlarged thymus gland to exophthalmic goitre, reports ten cases of his own and has compiled one hundred and thirty-three cases from literature. He states that fully 76.5 per cent of all exophthalmic patients who died after operation had an unusually large thymus gland. Matti states that it seems very evident that the thymus and thyroid gland are in concert, and that each aggravates the morbid condition induced by abnormal functioning of the other.

GALT<sup>1</sup> states that the conception of a surgical operation upon the thymus gland for the relief of Basedow's disease was based upon the fact that in cases of severe and fatal forms of Basedow's disease death is almost without exception due to a persistent thymus. In one case of

severe Basedow's disease he performed a thymectomy without touching the goitre, and obtained improvement in the heart's action, the disturbance of the characteristic Kocher's blood-picture, and a decided increase in the body weight. In a second case he performed the operation, but at the same time removed one-half of the thyroid gland, and obtained a good result. He quotes Capelle, who claims that the symptoms of Basedow's disease are intensified in the presence of an enlarged thymus gland. He draws the following conclusions regarding the correlation of the thymus and thyroid glands in Basedow's disease.

*First*—After extirpation of the thymus gland the characteristic blood-picture of Kocher disappears, just as it does after successful thyroidectomy.

*Second*—His assistant, Doctor Bayer, has been able to reproduce the typical blood-picture in animals by the peritoneal injection of thymus pressure fluid from a case of Basedow's disease.

*Third*—After the removal of the thymus gland six months later retrograde processes were observed in the thyroid gland removed at a secondary operation and subjected to microscopic examination.

*Fourth*—In thyroidectomized animals Gebele, by the employment of the thymus gland, was able to prevent the typical condition of cachexia strumepriiva.

*Fifth*—The experiments of Bircher, who has been able to reproduce pronounced Basedow's disease in dogs by the intra-peritoneal implantation of fresh pathological persistent thymus.

Garre does not wish to go so far as Hart, who speaks of a thymogenic cause for Basedow's disease, but thinks that there is a certain group of Basedow cases which are complicated by a persistent hyperplastic thymus gland. These cases can be characterized as severe types of the disease. He further relates (p. 58) that persistent thymus gland is found in ninety-five per cent of all fatal cases of Basedow's disease in which a thyroidectomy had been performed.

CROTTI and BOWEN<sup>11</sup> have emphasized the importance of the enlarged thymus gland in those cases of death following the operation of thyroidectomy for Basedow's disease and have been able to diagnose enlargement of the thymus gland with the Röntgen ray. They reported five cases of this kind.

CAPELLE and BAYER,<sup>12</sup> in their contribution on thymectomy in Basedow's disease, state that they and others are of the opinion that the symptoms of Basedow's disease are made more severe when a thymus gland is present, but do not agree absolutely with Hart, who goes still further and ascribes to the thymus gland (Hart, *Munch med Wochenschrift*, 1903, 13, 14) the primary cause of Basedow's disease in its direct action by producing pathological changes and oversecretion of the thyroid gland.

V. MIKULICZ<sup>(13, 14, 15)</sup> came to the conclusion that the conception of Basedow's disease should in no way be explained solely through an excessive function of the thyroid gland. His conception of the disease as given by him before the German Surgical Congress of 1895 is that the thyroid gland acts as a multiplier or intensifier of the symptoms.



In view of the experimental production of Basedow's disease through the transplantation of the thymus gland by Bircher, as well as the experiences of Garre with thymectomy as a cure for Basedow's disease, it is not at all improbable that the "multiplier" theory of Mikulicz with the thymus gland as the primary lesion may perhaps be correct

*Artificial Clinical Production of Basedow's Disease and Hyperthyroidism*—Basedow's disease has been accidentally produced in man by the excessive administration of thyroid extract and iodine preparations. It is a well-known clinical fact that the administration of such remedies to patients suffering from exophthalmic goitre will cause an exaggeration of all of the symptoms.

Von Notthaft<sup>16</sup> reports a very interesting case of a man in whom artificial production of acute Basedow's disease occurred from the use of thyroid extract taken for obesity. The man developed a typical picture of Basedow's disease, exophthalmus, tachycardia, nervousness, emaciation, and glycosuria, the symptoms disappearing again after ten months. This case has become classical in the literature of Basedow's disease, and a detailed abstract of it will not be amiss.

VON NOTTHAFT'S case was as follows:

Male, aged 43, who had always been well, with no neuropathic taint, no alcoholic or venereal history, suffered for several years from progressive obesity. The associated discomfort led him to take various "cures."

The results following these obesity cures were not good, and he then tried the use of thyroid tablets (thyroidin) without consulting a physician. In December, 1896, he procured, through the aid of a druggist friend, some thyroid gland tabloid preparations of Burroughs, Wellcome & Co (0.3g) and within a period of five weeks he used about 1000.

He began with 3 tabloids t.i.d., and as the results were not rapid enough to suit him he took 10 tablets t.i.d., and later 15 tablets t.i.d. He lost about 30 pounds in weight, weighing 220 pounds when he began, a decrease of about 13.64 per cent—an exorbitantly high ratio. The first symptoms of Basedow's disease set in at the end of the third week and were evidenced by an irritative cough with swelling of the neck. At the end of the fourth week the neck enlargement had increased, and palpitation of the heart, with insomnia, was present. About the end of the fifth week he experienced excessive thirst.

Toward the end of the third week his symptoms grew worse, and by the end of the sixth week he desisted in further self-medication and consulted medical advice. After the appearance of the irritative cough,

he observed that his shirt collar was too tight, the circumference of the neck seemed to have suddenly increased about 3 centimetres, he became dyspnoeic and had palpitation of the heart. Fatigue and depression were marked. He became so excitable that he could not sleep at night, this was coupled with the fact that he could hear his neck arteries beat. His appetite remained undisturbed, stools and urine were normal. An attack of rheumatism in the last days of the treatment he ascribed to the excessive sweating which had been present for some days. The loss of weight was as follows

At beginning	220 pounds, 3 tablets t i d
Middle of first week	? pounds, 10 tablets t i d
Towards end of first week	218 pounds, 10 tablets t i d
End of second week	214 pounds, 10 tablets t i d
End of third week	206 pounds, 10 tablets t i d, first symptoms
Beginning of fourth week	? pounds, 15 tablets t i d, increased symptoms
End of fourth week	200 pounds, 15 tablets t i d, insomnia and palpation.
Beginning of fifth week	? pounds, 2 tablets t i d
End of fifth week	196 pounds, 2 tablets t i d, thirst excessive
Beginning of sixth week	192 pounds, until then 3 tablets t i d

Upon examination on January 15, 1897, the following were the physical findings

Adiposus well developed, the face is slightly reddened, the entire skin feels very moist. At first glance one notes two prominent symptoms considerable exophthalmus and a moderate tremor, which is more pronounced in the hands. The neck is thick, and a marked enlargement of the thyroid gland can be noted, the neck circumference at the largest point is 47 centimetres. Palpation shows the thyroid with both lobes considerably enlarged (*Nicht unerheblich vergrössert*), palpable thrill and vascular sounds are not present. The carotids and brachials pulsate visibly. Pulse is soft, regular, 120, respiration about 24 and more. Axillary temperature,  $37.3^{\circ}$  C, weight 192 pounds. Liver and spleen unchanged. Abdomen soft, not sensitive to pressure. Lung and heart outlines normal, apex beat increased and widened in fifth intercostal space, within the mammillary line. Exophthalmus equally prominent on both sides, can completely close the lids, Stellwag's sign is clearly noted, and on lowering of the visual level the upper eyelid moves only imperceptibly downward (Graefe's sign). Pupils react, vision, eye grounds and power of convergence show no abnormality. The protruded tongue trembles markedly, as is the case in a patient affected with cerebral lesion. The urine contains 1 per cent of sugar, daily quantity 3 litres plus.

Thyroid medication was stopped at once, hypnotics and Fowler's solution were administered. In ten days improvement was first manifested by an improved mental condition, then the nervousness abated, and fourteen days after the first consultation the patient stated that he felt better than ever. The sugar in the urine disappeared after ten days. The polyuria and thirst began to disappear after this. For about four weeks no effect was noted on the heart and pulse, then slowing of the pulse-rate to 80 and 90, but even eight weeks after examination slight excitement sufficed to run it up to 110 and 120. At this time the apex beat was hardly palpable any longer. The irritative cough left after the eighth day, the tremor was no longer observed after four weeks. On the other hand, struma, exophthalmus, and the other eye phenomena remained for six months and then gradually receded. In October,

1897, the patient was again examined and none of these symptoms were found. In the meantime the patient (without the doctor's knowledge) took 0.3g t.i.d. of iodothyrim and remained well. His weight is now 204 pounds.

BALL<sup>17</sup> reports a very interesting case of exophthalmic goitre with acute symptoms and death probably caused by the use of thyroid extract. Patient was a female, aged 24, who had been taking five-grain tablets of thyroid extract for over a year to reduce a thyroid swelling. Death took place from acute thyroidism. Before death, temperature reached 106, pulse 200, respiration 70. The acute symptoms lasted less than four weeks. Autopsy gave negative findings relating to the cause of death other than that of acute exophthalmic goitre.

THEODORE KOCHER<sup>18, 20</sup> reports a case of acute Basedow's disease as the result of the internal and local treatment of a simple goitre with iodine preparations. After three weeks the patient had all the typical symptoms of Basedow's disease, and after extirpation of the thyroid, which was about the size of a man's fist, it was found to contain an unusually large amount of iodine. Kocher thinks this condition should be termed iodism of the thyroid gland, as the symptoms are identical with those that are obtained by the administration of large doses of thyroid extract. He states that mild symptoms of Basedow's disease are to be observed very often in cases of ordinary goitre where there is a misuse of iodine. He has designated this condition as a special form of the disease, namely, "Iodbasedow" or "Iodinebasedow".

PINKES<sup>21</sup> verifies Kocher's observation, and reports six cases of Basedow's disease produced through the administration of iodine.

PULAWSKI<sup>19</sup> reports three cases in which he observed Basedow symptoms developed after the treatment by iodine and thyroid extract.

WOLFSOHN<sup>22</sup> experimented to determine the sensitiveness of Basedow patients to the ingestion of iodine preparations. He utilized for these experiments guinea pigs in which he had previously injected serum obtained from Basedow patients. He found that after twenty-four hours these animals were oversensitive to iodoform.

SEITZ, BERG, and WOLFSOHN<sup>23</sup> have observed thyroidism and acute thyroiditis after the administration of potassium iodide and iodine preparations.

THEODORF KOCHER<sup>24</sup> relates that Tourin, one of his assistants, has examined a large number of cases of ordinary colloid goitre and found no change in the normal blood-picture. However, after the administration of iodothyrim he obtained the typical blood-picture of Basedow's disease,—i.e., typical leucopenia with diminution in the neutrophile cells, with an increase in the lymphocytes.

*Pathology of the Thyroid Gland in Basedow's Disease*—Specific changes in the thyroid gland for Basedow's disease have been described by the Kochers, MacCallum, Wilson and MacCarty. An enlargement of the thyroid gland is always present in Basedow's disease. This has been commented upon frequently by C. H. Mayo and the Kochers. A case of Base-

dow's disease without an enlarged thyroid gland at operation is as yet to be demonstrated

A KOCHER,<sup>25</sup> in a histological and chemical examination of one hundred and sixty thyroid glands removed from cases of Basedow's disease, thinks that the conception of a papillary cylindrical cell hyperplasia as the specific histologic picture is not at all satisfactory, as such changes are only found in herds or may be entirely absent. This conception has given rise to the belief that there are no changes in the thyroid gland which are absolutely characteristic of the disease. Personally, A. Kocher agrees with the latter view. Kocher found all manner of changes in the one hundred and sixty cases examined, and definite conclusions could only be arrived at after taking into consideration the microscopic picture, the clinical examination, and the patient's history. The composite picture which Kocher obtained that might be said to be characteristic for Basedow's disease can only be expressed by saying that "evidences of increased absorption in all parts of the gland are to be found." In such glands there is found constantly increased liquidation of the contents of the follicles, with a relative or absolute enlargement or increase of the cells. These changes were dependent upon the amount and concentration of the iodine content of the follicles. He states that in Basedow's disease the thyroid gland takes up more iodine than does the normal gland. This storing up of iodine as compared with the normal gland varies greatly,—in other words, no relative proportion between iodine content and colloid, as is the case in the normal state. A more liquid iodine-containing content of the follicles gives a severe form of Basedow's disease.

Basedow symptoms do not occur where there is a dense content of the follicles. When such is the case there is usually an improvement in the general condition of the patient, while an increase of the iodine content without thickening of the content means an exaggeration of the symptoms. In Basedow's disease more iodine is taken through the thyroid gland than in the healthy state. The increase in vascularization was more pronounced in those cases where the secretion in the follicle was thin.

Histologic changes are dependent and secondary to the variation in the composition in the follicle content. He comes to the conclusion that in Basedow's disease there is a greater increase and absorption of thyroid products into the general circulation.

A. KOCHER<sup>26</sup> again reports the examination of thirty-five thyroid glands removed from patients with Basedow's disease, and states that his experience is now so extensive that from the clinical manifestations he is able to predict the exact histological conditions which will be found in the thyroid. He classifies them under four different groups. Kocher has been experimenting with the transplantation of portions of Basedow thyroids in patients suffering from hypo-thyroidism, as well as with desiccated Basedow thyroids. The effect seems to be the same as when the normal thyroid gland is used. Kocher thinks that this speaks for a hyperthyroidism as the cause of Basedow's disease and as an

evidence against the dys-thyroidism theory. He states that the amount of iodine found in the thyroid gland of Basedow patients varies greatly—either far above or far below the normal average.

WILSON and MACCARTY<sup>27, 28</sup> have described typical changes in the thyroid gland of patients suffering from Basedow's disease. These changes consist mainly in the histologic picture, showing an increase in the epithelial or secreting surface of the gland. In the Surgical Section of the American Medical Association, at its recent meeting, Wilson of the Mayo clinic made the statement that in eighty per cent of the cases he could determine the clinical symptoms from the histologic findings.

MARINE and LENHART<sup>1</sup> report their studies of sixty-nine thyroid glands removed from exophthalmic patients. They found the changes variable. The most constant change, however, was found to be an active hyperplasia of the thyroid in connection with hyperplasia of all the lymphoid tissues. The exophthalmic goitre syndrome may co-exist with a normal thyroid, with a colloid goitre, with an active hyperplastic thyroid, as well as with an atrophic thyroid, or may be found with a tumor of the thyroid. They claim that active thyroid hyperplasia means thyroid insufficiency, and that the iodine content of the gland varies inversely with the degree of active hyperplasia. They also state that the degree of active lymphoid thyroid hyperplasia is therefore the best index of the severity of the disease.

*Blood Changes in Basedow's Disease*—THEODORE KOCHER<sup>29</sup> reports accurate blood examinations in one hundred and six cases of Basedow's disease, and describes a characteristic blood-picture. This blood-picture consists in a reduction of the polynuclear neutrophile leucocytes with an absolute or relative increase in the lymphocytes. He not only holds this blood-picture as typical, but utilizes it for the early diagnosis of the disease as well as for its prognosis. Both medical and surgical treatment influence this blood-picture very much. After thyroidectomy the total number of leucocytes are increased. The neutrophile cells increase and the lymphocytosis diminishes. In this manner Kocher is able to prognosticate as to cure after surgical operation. As Kocher operates many of his cases in successive stages, beginning with ligation of one or more of the superior thyroid arteries and gradually leading up to the thyroidectomy, he can observe the amount of improvement after each operation by the blood examination. The blood examinations of Kocher have been verified by v. Lier, Buhler, Turin,<sup>30</sup> and others.

REID HUNT<sup>31</sup> endeavored to throw some light upon the question of an excess of thyroid secretion in the blood of exophthalmic patients. He showed that when small amounts of thyroid extract are fed to mice for a few days the latter acquire markedly increased resistance to acetonitrile. He reports some experiments on white mice in which exophthalmic goitre blood was injected and the injection of normal blood served as a control. He states "That it required nearly twice as much acetonitrile to kill the mice which had received the exophthalmic goitre blood as it did those which had received normal blood or simply MacCa's." Reid Hunt thinks this evidence should be accepted as representing that the blood of exophthalmic goitre patients contains an excess of thyroid secretion. These experiments were corroborated by Ghedini,<sup>32</sup>

while Lussky,<sup>23</sup> after extensive experiments with the test upon several species of animals, as well as in one case in man, after thyroid feeding, states "Inasmuch as there are, at least under certain conditions, other substances than thyroid in the blood which increase the resistance of mice to acetonitrile, and since these substances may vary in different individuals, or at different times in the same individual, the Hunt test on human exophthalmic goitre blood lacks sufficient control. In the case of positive results it is impossible to say which substances are present." The Kochers, however, regard Hunt's test of great value.<sup>24 20</sup>

*Secondary Basedow's Disease* —One of the most important facts which speaks for the thyroid origin of the symptoms of Basedow's disease is the so-called secondary form of Basedow's disease,—i.e., symptoms of hyperthyroidism or typical Basedow's disease appearing in connection with other affections of the thyroid gland, such as simple and adenomatous goitre, cancer and inflammations.

It is a common clinical experience with those who see many cases of goitre to have patients present themselves with a history of a long-standing enlargement of the thyroid, while the symptoms of hyperthyroidism or exophthalmic goitre are only of recent date. This has been observed and commented upon by Kocher (20, p. 10) and others.

The frequency of hyperthyroidism and Basedow's disease in association with malignant diseases of the thyroid has been observed by Bloodgood and Kocher.

Kocher<sup>24 20</sup> speaks (p. 625) of cases of malignant struma which presented themselves with very pronounced symptoms of Basedow's disease, and the malignant nature of the goitre was not discovered until it was too late for radical operation.

Pieri<sup>34</sup> reports a case of spontaneous cure of Basedow's disease as a result of suppurative thyroiditis in which a part of the thyroid gland was destroyed by the inflammation.

*Kocher's Conclusions* —Kocher,<sup>24</sup> 1911, in a very exhaustive *résumé* of the advances made in the study of Basedow's disease, states that the following conclusions relative to this disease are warranted.

*First* —All cases of Basedow's disease are based upon pathological changes in the thyroid gland which produce a disturbance in the function of that gland. No one has as yet been able to demonstrate a Basedow case with normal thyroid gland. He has repeatedly shown enlargement of the thyroid gland in such cases at the time of operation where the thyroid gland could not be palpated before operation.

*Second* —The disturbance of function manifests itself in the thyroid

excretion, which has a toxic action upon the nervous system. The only constituent of the thyroid gland whose physiologic and pathologic action is understood at the present time has been shown by Oswald and A. Kocher to be the iodine-containing thyro-globulin found in the colloid of the alveoli in the thyroid gland.

*Third*—According to the researches of Bauman, Roos, Oswald, Reid Hunt, and A. Kocher, the thyroid secretion which enters the circulation depends upon the quantity of iodine which it contains for its action.

*Fourth*—That Basedow's disease is a hyperthyreosis in the sense that either more secretion from the thyroid gland enters the circulation or, if not an excessive amount of secretion, an excessive amount of iodine.

*Fifth*—Up to the present time we have no proof of a dysthyroidism in which the abnormal thyroid gland gives off its iodine content in the form of pure iodine. For the hyperthyreosis or hypersecretion as the functional disturbance of the thyroid gland in Basedow's disease we have the facts that by the administration of thyroid extract from normal glands in cases of cachexia thyreopriva the symptoms of that disease can be made to disappear. On the other hand, Basedow symptoms can be produced with the same extracts if given in large doses, while symptoms of the disease can be produced experimentally by the administration of thyroid extract, and the characteristic blood-picture as described by A. Kocher can be reproduced. This blood-picture is the most simple and best means of diagnosis in doubtful cases of Basedow's disease.

*The Results Obtained from the Treatment of Basedow's Disease Based upon the Hyperthyroidism Theory*—The results obtained from treatment directed toward the overaction of the thyroid gland in Basedow's disease speak more in favor of the thyroid origin of the disease than do any other evidences or data which we possess at the present time. Such treatment has been either the (a) serum or antitoxin therapy, (b) the X-ray, (c) the surgical treatment.

(a) *Serum Therapy*—The fact that there exists an antitoxin for this disease from which cures and good results are being obtained is one of the most potent arguments in favor of the thyroid origin of the disease. Various sera have been recommended and employed. These are prepared from animals from which the thyroid gland has been removed or from animals inoculated with extracts of thyroid gland taken from patients suffering from exophthalmic goitre. The serum have been used by MacCallum and that prepared by Rogers and Beebe are those most frequently used. Good results from the serum treatment are reported by Rogers and Beebe<sup>25</sup> and Denic and Gardere<sup>27</sup>.

The latter report in detail the cure of a pronounced case of Basedow's disease by the use of Moebius's serum

BEEBE,<sup>30</sup> reporting the results obtained from the use of his serum, divides the cases into three groups. In the first group are those cases who have had the disease only for a short time, from two weeks to six months. In the second group are placed those patients who have had the disease for some time, from four to eight years. In the third group, those atypical cases which give the history of Graves's disease over a very long period of years.

The best results from the serum treatment are obtained with patients belonging to the first group, the percentage of recovery and marked improvement is 80 per cent. In the second group 50 per cent of the patients may be cured or improved, while in the third group the serum finds its smallest application, and the treatment cannot be relied upon alone, and no definite statement regarding the serum treatment in this class of cases can be made.

(b) *X-ray*—The fact that the X-ray applied only to the thyroid gland can modify, improve, or cure hyperthyroidism and Basedow's disease is another argument in favor of the Moebius theory.

RAVE<sup>28</sup> reviews the results obtained by the X-ray treatment of Basedow's disease and shows that the X-ray does have a favorable action upon the disease. He states that in fifty-one patients out of three hundred and twenty-one the nervous symptoms were improved. He comes to the conclusion that the X-ray treatment should be employed if for any reason an immediate surgical operation cannot be performed. He states that with this treatment the thyroid gland is reduced in size and specific symptoms of Basedow's disease, such as exophthalmus, cardiac and nervous symptoms, as well as the general condition of the patient, are improved. The patients also took on weight.

SIMON<sup>30</sup> reports a case of Basedow's disease treated by the administration of iodine in which there were very pronounced manifestations of iodo-thyroidism, which was brought to a cure in a very short time by X-ray treatment of the thyroid gland.

BERGER and SCHWAAB<sup>4</sup> sent question blanks to a number of German internists asking for their experiences in the Rontgenization of the thyroid gland in the treatment of goitre. The majority of clinicians who replied stated that favorable results were obtained in Basedow's disease, and some regarded it as fully equal to any other therapeutic method.

The enlargement of the thyroid gland subsides after this treatment, as well as do the other specific symptoms of Basedow's disease.

(c) *Surgical Treatment*—MELCHOIR,<sup>41</sup> in the most exhaustive and complete *résumé* of the literature of Basedow's disease up to 1910, states that in the majority of cases of



Basedow's disease it is possible, through the diminution in the size of the goitre by surgical measures, to cure, or at least to produce an improvement which borders on absolute cure. He gives the available figures of 65 to 75 per cent of cures, and further states that so far the operative treatment of Basedow's disease is the best remedy. The cure in some cases is proportional to the amount of thyroid tissue removed. The early operation is recommended for two reasons.

*First*—That the operative mortality in advanced cases of Basedow's disease is very high, while in the beginning of the disease it is very low, not higher than that for ordinary simple forms of goitre.

*Second*—Even if a successful operation is performed in advanced cases, the heart changes very seldom are relieved.

Melchoir reviews the results obtained as follows:

Wolff	1898	9 cases,
Helferich	1898	6 cases
Von Mikulicz	up to 1900	18 cases
Witmer and Kroenlein	1900	23 cases
Kummell	in 1901	20 cases
Curtis	in 1903	11 cases
Koenig	in 1905	8 cases
Hartley	in 1905	21 cases
Riedel	in 1906	50 cases
Garre	in 1908	28 cases
Klemm	in 1908	32 cases
Kocher	up to 1908	320 cases
Mayo	up to 1907	176 cases
Halstead	1907	90 cases
Landsstrom	1907	54 cases
McCosh	1908	22 cases
Hanel	1909	21 cases
A total of		909 cases

There was approximately 65 to 75 per cent of cures.

C H MAYO<sup>4</sup> reports over eleven hundred operated upon for hyperthyroidism at the Mayo clinic, and states that about seventy per cent of the patients consider themselves cured, and apparently they are well. The others were improved but not well on account of late operation when severe secondary effects of disease were present.

H ALVARTINE and PEPPIN<sup>4</sup> reviewed the results obtained by V Mikulicz, Kroenlein, Kocher, Kummell, Riedel, Garre and Ackerman from their operations on the thyroid gland for the relief of Basedow's disease. They endeavored to determine the late results of the operation, and only those cases which had been under observation at least three years after the operation were considered. In 120 cases 85 or 70.8 per

cent were absolutely cured, in 27, or 22 per cent, there was marked improvement, and in 8, or 66 per cent, there was no improvement

The general favorable result, approximately 70 per cent of cures as given above, seems to prove that not only is the thyroid gland the seat of the principal disturbance in Basedow's disease but that we cannot ascribe the cure to any other reason but to the operation itself

Various methods of operation have been employed, such as ligation of the thyroid arteries, pole ligation, resection of the cervical sympathetic ganglia, resection of one lobe either alone or in combination with a hemi-section or ligation of the opposite lobe, but experience seems to show that the best results are obtained from the resection operations. The surgical treatment of this disease has been progressing and is better understood to-day than it was a few years ago, and many of the cases which formerly were not cured or relieved by a surgical procedure did not have a sufficient amount of thyroid tissue either rendered functionless or removed. At the present time there is no definite standard for the amount of thyroid tissue to be removed, this is largely a matter of judgment and experience with the operator

Halstead<sup>44</sup> states that although thousands of operations have been performed the world over, for the cure of Graves's disease, we are not as yet in a position to state how much of the thyroid gland should be removed in any given case. Some of the severest cases have been sufficiently cured by the removal of one lobe, and in some of the mildest the excision, almost total, of both lobes has been necessary to bring about a cure or a satisfactory condition

### CONCLUSIONS

From the foregoing review of the experimental and clinical evidences relating to the thyroid origin of Basedow's disease the following conclusions are warranted, viz.

1. Basedow's disease can and has been produced experimentally in lower animals by the injection of thyroid extract fluid (Klose), by implantation of the thymus gland (Bircher),

and by the injection of the macerated thyroid gland (Baruch)  
Symptoms closely resembling Basedow's disease can be produced in animals by thyroid feeding

2 The evidence at hand indicates a close relationship between the thymus and thyroid glands

3 That the symptoms of Basedow's disease are due to either an excess or perverted secretion of the thyroid, with the primary disturbance existing in the thymus gland, the action of the thyroid being that of a "multiplier" according to the theory of von Mikulicz

4 Basedow's disease has been produced in man by the excessive administration of thyroid extracts and preparations of iodine

5 That there are changes in the thyroid gland, chemically, macroscopically, and microscopically, which are characteristic for Basedow's disease

6 Typical Basedow's disease or symptoms of hyperthyroidism (so-called secondary Basedow's disease) occurs after or in connection with other affections of the thyroid, such as simple and adenomatous goitre, cancer, and inflammations

7 That there is a characteristic blood-picture in Basedow's disease which disappears after the surgical removal of a sufficient amount of the diseased thyroid tissue

8 The successful treatment of Basedow's disease by measures directed toward the thyroid itself, as well as by serum therapy, proves the thyroid origin of the disease

9 Basedow's disease can be cured by the surgical removal of portions of the gland in approximately 70 per cent of all cases

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# A CHEEK DEFECT AND ITS REPAIR BY PLASTIC OPERATION.\*

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## HISTORY OF CASE

A BOY, 16 years of age, was referred to me for treatment by Dr John M T Finney. He was admitted to the Union Protestant Infirmary, January 25, 1912, suffering from a large defect involving entire thickness of the right cheek (Fig 1)

The patient said that in February, 1910, he had a severe attack of typhoid fever, and was in bed about ten weeks. While he was in a comatose condition a small ulcer appeared on the inside of the right cheek, which spread and finally destroyed the entire thickness of the cheek. This was evidently cancrum oris.

When admitted there was a circular, funnel-shaped opening involving the entire thickness of the right cheek. The external diameter was 6.3 centimetres, and the internal was 3.8 centimetres. The defect extended from the level of the hard palate to the floor of the mouth, and from the ramus of the jaw to within half an inch of the angle of the mouth. The thickness of the posterior wall was 4.4 centimetres. The walls of the defect were made up of very dense scar tissue of woody hardness. The scar tissue also involved the adjacent soft parts of the cheek. Posteriorly, a thick column of scar tissue encroached upon the oral cavity, and this, with a smaller band anteriorly, seemed to bind the jaws together.

Both the upper and lower jaw bones on this side had evidently been involved in the destructive process, and were covered with dense scar tissue, which was continuous with the walls of the defect. The parotid duct could not be located. All the teeth were missing on the right side, excepting one or two incisors. The tongue, on this side, was closely adherent to the body of the

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\* Read before the Southern Surgical and Gynecological Association, December 18, 1912

lower jaw, and along the floor of the defect, to such an extent that, of the right side of the tongue, only the tip could be moved

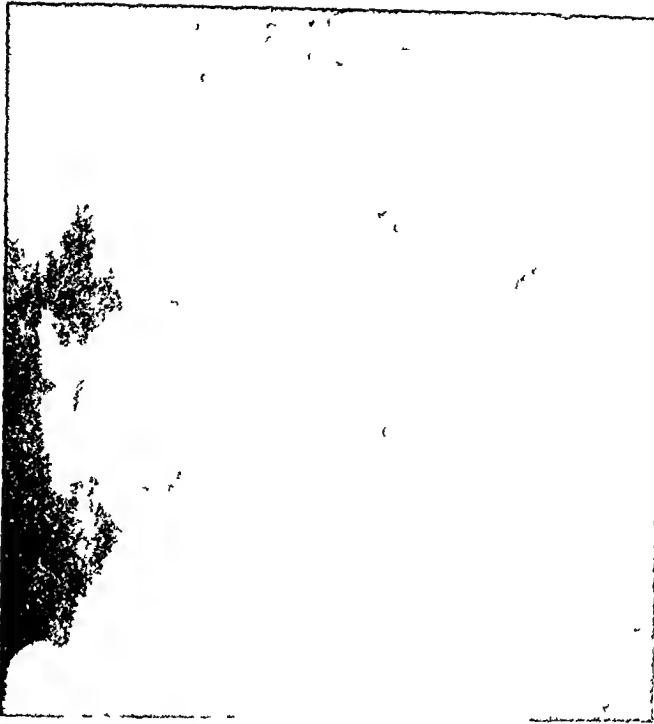
The patient was unable to open his mouth even with the greatest effort. This condition seemed due to the scar tissue, and not to any trouble with the joints, as a certain amount of joint movement could be demonstrated. All of the teeth were in bad condition. Articulation was very indistinct, and talking was impossible unless the opening was plugged with a dressing. The patient was obliged to force his food with his finger back behind the teeth on the left side, and was unable to feed himself through the defect, as the unequal movements of the tongue forced the food back through the opening.

After a careful study of the case I came to the conclusion that for the repair of this large defect a flap with a broad pedicle presented the greatest promise of success, as a good blood supply was imperative to combat infection and to nourish the flap until the new vessels from the surrounding tissues could take care of it. It was necessary that this flap should fulfil several conditions: (1) It should not contract appreciably after being implanted. (2) It should have enough thickness to fill the defect without causing a depressed area after healing was complete. (3) It should be formed of soft tissue (preferably fat, with whole thickness skin on both sides) which would conform in appearance to the surrounding skin externally and take the place of the mucous membrane in the mouth.

In order to avoid any further mutilation of the face or neck I determined to utilize the right arm, as I was able to secure a flap from this region which would fulfil every requirement.

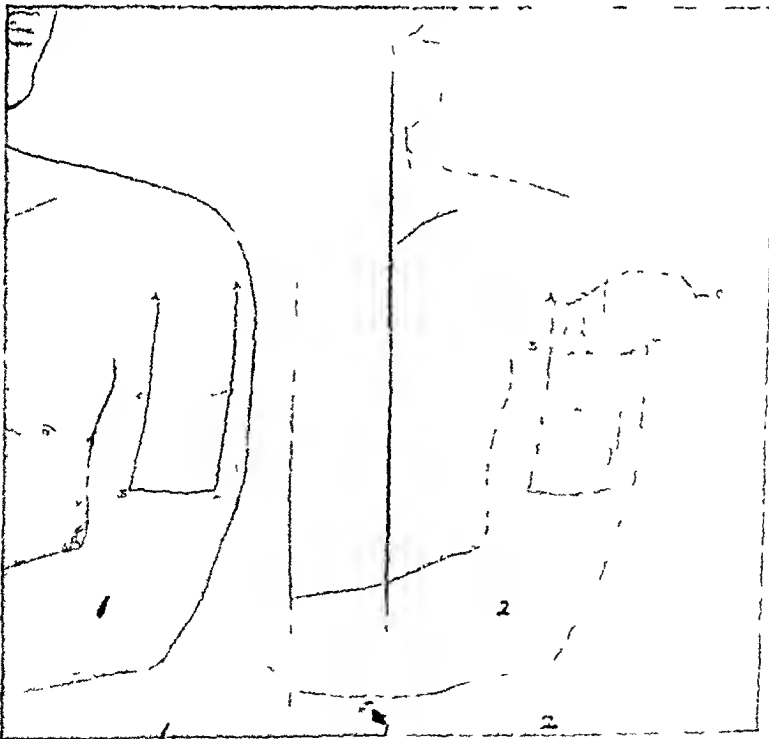
January 29, 1912—*Operation*. Nitrous oxide-oxygen anaesthesia. A large pedunculated, rectangular-shaped flap 7.5 x 16 centimetres, made up of whole thickness skin, with its subcutaneous fat, was raised from the outer side of the right arm. The base of the flap was in the mid-deltoid region. The flap was folded on itself, and the distal end was sutured to the pedicle and underlying muscle. A few interrupted sutures were placed at intervals in the edges, thus bringing raw surface to raw surface and forming a flap with a double thickness of fat within, and with whole thickness skin on front and back (Fig. 2). A number of small stab wounds were made in the flap to relieve congestion. The flap was then stretched by means of four

FIG 1



Defect in cheek before operation. Note depth of posterior wall and extent of scar-tissue involvement around the opening. The tongue can be seen adherent to the lower portion of the defect.

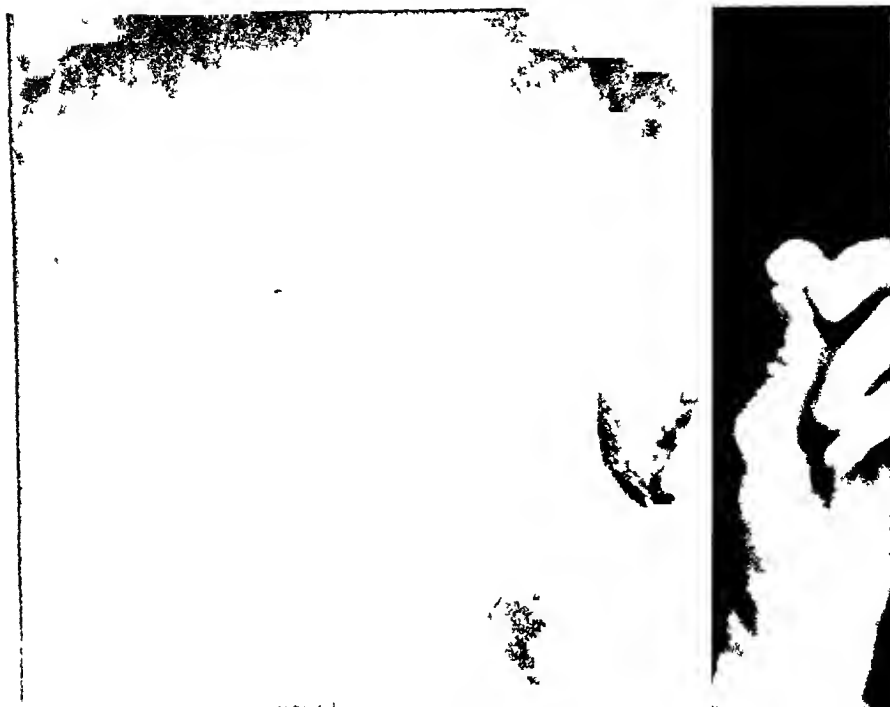
FIG 2



Schematic drawings, showing method of formation of flap. 1. Outline of flap. 2. The flap was folded on itself at C. The distal end B was brought up and sutured to the pedicle and underlying muscle at A. Several sutures can be seen holding the edges together and forming a flap with a double thickness of fat within and whole thickness skin on front and back. The double faced flap was held flat on a wire frame. It was not transplanted until two weeks later, in order not to disturb the healing process between the raw surfaces and to allow for shrinkage and the adjustment of the circulation. D, the area from which the flap was raised, was grafted immediately with Thiersch grafts from the thigh.



FIG 3



portion of the cheek defect. Note the thickness of the  
Photograph was taken nine days after amputation of

FIG 4



sutures on a gauze-covered wire frame, to keep it flat and to control the contraction. Dressed with moist salt gauze. The area from which the flap was raised was grafted immediately with Thiersch grafts from the thigh. Silver foil, rubberized mesh, and dry gauze dressings.

February 11 —The flap was in excellent condition. There had been little shrinkage. The Thiersch grafts on the arm had taken *in toto*.

February 12 (fourteen days after the flap was formed) —  
*Operation* Ether anæsthesia. As much as possible of the scar tissue was removed from the sides and upper portion of the defect. This was attended with considerable difficulty and much bleeding. The tongue, which was adherent almost to its base, was freed and drawn to the left side, and an attempt was made to close the raw surface. Even after dissecting out the scar tissue bands the jaws could not be opened to any extent, and this was probably due to the great infiltration of the muscles with scar tissue.

The flap on the arm was then opened across its free end and its edges freshened. The arm was raised into position and the flap was sutured into the defect. Catgut was used in the mouth and through the fat, and silk on the cheek. In this way the upper two-thirds of the defect was filled. The arm was then held by means of a plaster bandage, which also included the chest, shoulder, and head. The flap was dressed with moist salt gauze.

The patient was placed on a Gatch bed and every effort was made to keep him comfortable. Continuous salt solution by rectum was commenced and kept up for several days. Constant attention was given to the toilet of the mouth. Only sterile water was given by mouth until the third day, when nasal feeding was begun and continued until the pedicle of the flap was amputated. The nasal feeding was not commenced earlier, as vomitus would have been difficult to handle.

February 23 (eleven days after implantation) —The circulation seemed well established from the cheek. The flap had healed nicely, both inside and out. The cast was removed, and under local anæsthesia the pedicle was cut through close to the arm.

March 3 —There had been very little shrinkage of the flap since the last note. The general condition of the patient was excellent (Fig. 3).

March 4 (eleven days after amputation of pedicle) — *Operation* Ether anæsthesia The scar tissue was dissected out from the lower third of the defect, and, after trimming and freshening the edges of the flap, it was sutured in, so as to completely close the remainder of the opening

March 18—The healing, both within the mouth and on the cheek, was very satisfactory, except for a small sinus in the lower anterior angle of the flap, which did not connect with the mouth

The tongue could be moved freely Articulation was plainer and the patient could feed himself with more satisfaction than before the flap was implanted In spite of as thorough excision of scar tissue as could be undertaken and closure of the soft parts, a dense band had re-formed at the anterior edge of the flap, close to the angle of the mouth This seemed largely responsible for the inability to open the jaws

March 27—*Operation* Ether anæsthesia An incision was made through the angle of the mouth back to the scar tissue band, which was then excised The anterior edge of the flap was loosened and sutured to the mucous membrane As much as possible of the remaining scar tissue was excised or divided, but the involvement of the deep tissues of the cheek did not allow much jaw movement The angle of the mouth was closed The jaws were held apart by a wooden wedge forced between the teeth

April 4—Some progress had been made in opening the jaws by means of wedges, but this could not be forced on account of great soreness of the teeth Injections of fibrolysin were begun in hopes that it might have some softening effect on the dense scar tissue, and these injections were continued daily until 26 doses had been given No softening effect was noted During the healing there had been a contraction of the scar tissue in some places around the flap, causing a depressed scar

May 20—*Operation* Ether anæsthesia The depressed scar was excised, and at the same time a further effort was made to loosen the jaws by dividing scar tissue, but with little success

June 2—Patient discharged *Condition* General health excellent. The defect was entirely closed with a thick flap which was nearly level with the surrounding tissues There was wonderful improvement in the appearance of the patient The

flap was in excellent condition. The skin was soft and pliable and of normal color. Within the mouth the skin was whitish and soft, and seemed to be gradually taking on the characteristics of the mucous membrane. It had united as satisfactorily to the surrounding tissues as had the external layer. The jaws could be opened so that the tip of the finger could be introduced between the incisor teeth, and there was considerable lateral motion. There was free motion of the tongue. The boy could talk much plainer than when admitted, and the feeding process was simplified.

The courage and cheerfulness of the patient helped materially during the tedious treatment.

*Remarks*—The general physical condition of the patient was of the utmost importance, and rest, fresh air, forced feeding, and tonics were resorted to. In addition, particular attention was given to the cleanliness of the mouth, and the services of a dentist were obtained. Nasal feeding was inaugurated after each operation involving the mouth cavity, and I wish to emphasize the importance of this method of feeding in similar cases, as feeding by mouth while the wound is fresh adds materially to the chance of infection, especially where there is so much difficulty in keeping the mouth clean.

On several occasions systematic attempts were made after dividing or removing the scar tissue to force the jaws apart by means of mouth-gags, wooden wedges, and screws, but they were only partially successful.

In a cursory glance through the literature I have not encountered just this method of utilizing the "flap from distant part principle" for closing a cheek defect.

The operations of Israel,<sup>1</sup> Hahn,<sup>2</sup> and Czerny<sup>3</sup> are the only ones, as far as I can find, in which a portion of the same whole-thickness pedunculated flap is utilized to close both the defect in the mucous membrane and also in the skin. Israel secured his flap from the neck, Hahn from the chest, and Czerny from the cheek and neck.

All methods of closing such defects are tedious in their accomplishment, and this method is no more so than the

others, and has, I think, advantages which make it desirable.

By the method of treatment used in this case the defect was filled with a thick flap of tissue with whole-thickness skin on both sides. The circulation of the flap was assured before the transplantation was begun. Most of the shrinkage of the flap had taken place before it was transplanted. There was no unsightly scarring of the cheek or neck. The area from which the flap was raised was entirely healed by means of Thiersch grafts by the time the flap was ready for transplantation, and thus one chance of secondary infection was eliminated.

The only serious disadvantage of the method is the constrained position of the patient during the time the circulation from the cheek is entering the flap. This position apparently causes little discomfort after the first 48 hours. This patient did not even complain of soreness in the shoulder after the pedicle was amputated and the arm lowered to the side.

In a letter of recent date the patient says he is attending school and doing well. His appearance is so much improved that it causes him no concern. He can eat with comfort and pleasure, and is able to talk much plainer than before operation (Fig. 4).

On the whole the result is very satisfactory, although there is still limitation of the jaw movement. Furthermore, and most important, is the fact that the patient is relieved of a hideous deformity, which would have prevented his living a comfortable, healthy life, and would probably have interfered with his obtaining lucrative employment.

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<sup>1</sup> Israel, J. Arch. f. klin. Chir., Berlin, Bd. 36, 1887, S. 376.

<sup>2</sup> Hahn, E. Verh. d. Deutsch. Gesellsch. f. Chir., 1887, 1, S. 102.

<sup>3</sup> Czerny, V. Beitr. z. klin. Chir., Bd. 4, 1889, S. 621.

# TEMPORARY ARREST OF THE HEART BEATS FOLLOWING INCISION OF THE PERICARDIUM FOR SUPPURATIVE PERICARDITIS

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No doubt, the rarity of an operation for suppurative pericarditis is sufficient to warrant its reporting. But, in addition to the surgical interest of this condition, the observation noted during the operation is a further reason for publication. This particular observation—temporary arrest of the heart on incision of the pericardium—may have a physiological significance, the importance of which, perhaps, has not been understood in the past, and the recognition of which may influence, in the future, the development of the technique of cardiac surgery.

The patient whose history is detailed below entered the Second Surgical Division of Fordham Hospital, in the service of Dr William P Healy, to whom the writer is indebted for the privilege of operating on and reporting the case.

*History* The patient, a thin, poorly-nourished, anemic child, aged 11 years, was admitted September 10, 1912, to the Medical Ward of the Fordham Hospital, and on the same date transferred to the Second Surgical Division. Present illness began one week ago. Complained of pain in the left thigh, which has persisted. Swelling of the left thigh. No chill. Slight elevation of the evening temperature.

When admitted her pulse was rapid, weak, and irregular. Heart sounds weak and distant. Dulness, bronchial breathing, increased fremitus, and moist râles at left apex. Numerous moist and crepitant râles over left chest. Dulness, decreased fremitus, and diminished voice and breath sounds at base of left lung. Intensified breathing over the entire right lung.

Her abdomen was moderately distended. No mass can be felt. Liver, spleen, and kidneys not palpable. The left thigh is swollen, red, and tender. Deep fluctuation can be elicited. Temperature,  $100\frac{2}{5}$ . Pulse, 126. Respirations, 24.

Soon after the patient had been transferred to the surgical ward, the left pleural cavity was tapped and six ounces of turbid fluid obtained. A microscopical examination of this fluid revealed some pus-cells. No tubercle bacilli and a few Gram-negative staphylococci.

September 11, 1912—General condition is somewhat better. The heart action is much embarrassed, the sounds being almost inaudible. A hypodermic needle was inserted into the pericardial sac and thirty minims of turbid serum obtained. Microscopical examination showed no tubercle bacilli. A cytological count showed polymorphonuclears, 49 per cent, large lymphocytes, 33 per cent, and small lymphocytes, 78 per cent. The culture plates were contaminated. There was subsidence of the swelling of the thigh, though tenderness was marked. Temperature, 100 to 102. Pulse, 112 to 130. Respirations, 28 to 40.

September 12—The cardiac impulse is neither visible nor palpable. Percussion shows the left border of cardiac dulness 11 centimetres from the midsternal line. Dulness is also increased to the right of the sternum. The sounds are more regular, though still muffled. Flatness and absent breath sounds over the base of the left lung. Increased breath sounds over left apex. The left leg is slightly cyanotic and the thigh swollen and tender. Temperature, 100 to 100  $\frac{4}{5}$ . Pulse, 104 to 120. Respirations, 24 to 32.

September 13—*Operation* (Dr W P Healy). Incision and drainage of subperiosteal abscess of left femur. Ether narcosis. A vertical incision made on the inner aspect of the left thigh, a short distance above the knee-joint. The incision was deepened and a purulent collection encountered near the shaft. The bone was smooth and intact. Six packs of iodoform gauze were inserted and a dry dressing applied.

During the succeeding ten days the thigh wound drained freely. Her cardiac condition remained without improvement, with a tendency to become more accentuated.

September 25 (twelfth day *post operationem*)—The heart sounds are almost inaudible. The pulse rapid, weak, and irreg-

ular There is dulness over the left lung posteriorly The area of cardiac dulness is markedly increased It is evident that there is both a pericardial and pleural effusion Temperature,  $100 \frac{3}{5}$  to  $102 \frac{1}{5}$  Pulse, 118 to 130 Respirations, 28 to 40

September 26—Dr A F Brugmann, after examining the patient, advised, as a preliminary measure, aspiration of the left pleural cavity

This was done and twelve ounces of blood-stained fluid obtained Slight improvement followed, but the cardiac embarrassment still persisted Temperature, 100 to  $101 \frac{4}{5}$  Pulse, 92 to 132 Respirations, 30 to 56

September 27—Condition is poor The pulse is very weak and irregular Dyspnoea upon the slightest exertion Extremities cold and cyanotic Temperature,  $100 \frac{2}{5}$  to  $100 \frac{4}{5}$  Pulse, 98 to 134 Respirations, 40 to 60

September 28—Condition same as day before Temperature, 100 to 102 Pulse, 130 to 160 Respirations, 44 to 66 The patient was brought to the dressing-room and the pericardial area painted with iodine, a medium-sized trocar and cannula were introduced into the pericardial sac, the point of entrance being in the left fifth interspace, one and one-half inches from the sternal border Upon withdrawal of the trocar, purulent fluid was ejected under considerable pressure Three ounces had been obtained when the flow ceased It was apparent that more than simple aspiration was needed, hence operation was decided upon The patient was returned to the ward and the operating room prepared

*Operation* (Dr A H Harrigan) Ether-oxygen narcosis Dorsal position The incision was four inches long It began at the left sternal border and passed obliquely downward and outward, crossing the left costal cartilage at its centre One and one-half inches of the fifth rib and cartilage were removed with the bone forceps When the anterior mediastinum was opened several loud, hissing noises demonstrated that there had been an accidental laceration of the pleural reflection A gauze packing was placed in the outer angle of the wound to prevent further entrance of air into the pleural cavity

The pericardium was at least two inches distant from the surface of the chest It appeared thickened and covered with a semi-gelatinous material Several attempts were made to grasp



the pericardium with hæmostats so as to steady it before incision. Each time the hæmostats slipped. Finally, however, control of the membrane was secured and an incision two inches long made in the pericardial sac. Immediately upon opening the sac a large quantity of pus was forcibly ejected with a gush, forming a stream the height of which was at least two feet above the level of the patient. (Culture of this fluid showed staphylococci.)

Following this, the phenomenon mentioned in the title was noted. *The heart deeply placed within the pericardial sac lay absolutely motionless. No movement could be seen or felt. At the time of this observation an assistant palpating the radial artery could obtain no pulse. It was not determined whether the heart was in systole or diastole. The duration of this cessation of the cardiac action was not timed. Finally, when an attempt to introduce a gauze drain into the pericardium was made, the heart began to beat, and within a minute the action became tumultuous, causing the organ to spring forcibly against the chest wall.* After the introduction of the drain a voluminous dressing was applied and the patient returned to bed. The patient quickly recovered from the anæsthetic. During the remainder of the day and night the condition was satisfactory. The pulse was rapid but strong. Some restlessness at night required morphine. There was dyspncea upon exertion. Camphor and digitalis administered.

September 29.—The external dressings were removed. They were saturated with thin, yellow pus. An examination of the drain and wound showed no blocking. Fresh dressings were applied. The camphor was discontinued and whiskey added to the digitalis. Her condition was the same as on the day of operation.

In the evening of this day the child's parents became very much alarmed about her condition and decided to move her to her home. This decidedly rash action met the earnest protestations of the house staff, but to no avail. Her parents moved the patient from the hospital to her home in the lower East Side of New York a distance of at least nine miles, and among conditions decidedly prejudicial to her recovery. After staying there two days she was sent to Bellevue Hospital, where she died forty-eight hours after her admission.

In the absence of an autopsy it is impossible to speak

decisively as to the exact condition present. Reasoning, however, from the chain of clinical findings, it is extremely probable that the primary condition was a subperiosteal abscess of the femur, and the pericarditis was secondary, as the result of general sepsis. It is certain that the fatal outcome was hastened and perhaps aided by the premature removal of the patient during the most critical period of her illness. Possibly an earlier operation would have offered better prospects. A lesson learned from the study of this case is to use the exploring needle repeatedly as a diagnostic method if these cases are to be operated upon at a favorable period.

The fluid present, while not measured, easily amounted to a quart. The height to which it attained at the liberation indicated the extreme degree of intrapericardial pressure. That the pericardium may contain a large amount of fluid is explained by the softening produced in its walls by the inflammatory process. The sac, though normally resistant and elastic, becomes quite distensible.

The method of operative attack employed—simple resection of the fifth rib and cartilage—presents two disadvantages. The first is the indirect course of the drainage track, and the second consists in the liability of injury to the pleura. As a result of this technique, the resultant line of drainage passes from the pericardium obliquely forward and outward. This is objectionable. As mediastinitis is a frequent complication of suppurative pericarditis, it seems as though drainage directly forward through the mediastinum is indicated. Pleural injury seems extremely likely, for many of those who have studied the topography of the thoracic viscera (Dwight, Delorme, Sick, Quam, and Testut), agree that the reflection of the pleura and of the pericardium varies in many instances. An excellent discussion of the many operative procedures to expose the pericardium may be found in the monograph of Delorme and Megnon.

Considerable discussion has centred around the relative position of the heart in the presence of a pericardial effusion

In this instance the heart occupied a posterior position. This observation agrees with that of Eichel.

The striking feature of the operation was the peculiar and wholly unanticipated behavior of the heart when the pericardium was incised. The persistent "Stillstand" was indeed surprising. In order to determine whether this observation has been previously described, many case reports of operations for suppurative pericarditis as well as gunshot and stab wounds of the heart have been investigated. In several the reporters mention casually that a disturbance in the cardiac rhythm occurred when the heart was exposed, but none offered any explanation or even suggested that its occurrence may rest upon a definite physiological basis. In this regard the work of Heitler and Flint is of prime importance.

In 1910 Heitler published a *résumé* of his animal experimentation performed in Basch's Laboratory in Vienna. His article appears in the *Medizinische Klinik*, and is entitled: *Heizstörungen durch Reizung des Perikards. Vorschlag zur Kokainisierung des Perikards bei Operationen am Herzen*. Heitler noticed that as a result of electrical or mechanical stimulation of the pericardium in dogs marked irregularity in the beat of the heart occurred. Without detailing his experimental studies *in extenso*, it may be said that Heitler arrived at the definite conclusion that stimulation of the pericardium caused arrhythmia. In addition, he drew the deduction that the cardiac irregularity seen during the progress of pericarditis had its origin in irritation of the pericardium. Moreover, he recommended in operations upon the heart cocaineization of the pericardium, preliminary to its incision, in order to prevent consequent interference with the heart action.

Heitler constantly uses the word arrhythmia in describing the phenomena noted. This term, of course, is vague, and offers no suggestion as to what mechanism or nervous reflex is disturbed. Heitler makes no attempt to explain the arrhythmia in the terms of the modern heart physiology.

Flint, in an article entitled "Physiologic Basis of Thoracic Surgery," confirms Heitler's work, but, in addition, maintains

that the arrhythmia is caused by a vagus reflex. Flint sums up thus: "The manipulation necessary for the incision of the pericardium manifests itself with perfectly typical cardiac inhibition, which lasts as long as the irritation of the pericardium continues."

As a matter of historical interest, it is significant to find that Ranvier, in his *Leçons d'Anatomie générale*, which appeared in 1880, refers to a contribution by Engelmann, published in 1875, describing the following experiments by Tagliani. The heart of a frog was stripped of its visceral pericardium, and it was then found that the myocardium no longer contracted on being touched with a needle on its denuded portion, it did contract, on the contrary, when it was stimulated at the points where the pericardium was preserved. Tagliani explained this observation by the presence of sensory nerves in the pericardium, the stimulation of these nerves acting upon the centre which produces the movement.

Engelmann repeated these experiments and arrived at different results. The interpretation of Tagliani was regarded by Ranvier as erroneous. However, in view of our present knowledge, the original observation of Tagliani as to the physiological relations existing between the pericardium and the myocardium apparently contained a germ of truth.

As a result of a study of the above references, it seems logical to assume to state that there exists a physiological association between the pericardium and myocardium, and that stimulation of the former causes a disturbance in the rhythmic activity of the heart. The exact relationship is unknown. In view of this, it seems fair to assume that the "Stillstand" of the heart noted at operation was caused by irritation—incision or manipulation—of the pericardium. It is apparent that the entire subject requires further investigation.

If this relationship between pericardium and myocardium be definitely established, then it will be necessary to revise the present technique of cardiac surgery.

# MEMBRANOUS PERICOLITIS AND ALLIED CONDITIONS OF THE ILEOCÆCAL REGION.

BY JABEZ N. JACKSON, M.D.,

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To every surgeon probably has come once or oftener the humiliating experience of operating upon a patient for what he had carefully diagnosed as chronic appendicitis, only to find, after removal of the appendix, that the symptoms persisted without improvement. Oftentimes the primary operation has been supplemented by a drainage of the gall-bladder or, if the patient be a woman, by the removal of an ovary. And still the patient experienced no relief. Somewhat similar experiences have followed the surgical history of supposed gastric ulcer where gastro-enterostomy, in the absence of demonstrable pyloric obstruction, has proved so disappointing. To palliate our failures in these operations about the appendix, gall-bladder, and stomach we have been wont to fall back on the all-embracing diagnosis *neumasthema*, which enabled the surgeon to smoothly edge from under the load of responsibility, but left the patient hopelessly mired in the slough of despond.

Such experiences naturally have been exceedingly distressing to the conscientious surgeon and have correspondingly stimulated our zeal in efforts to avoid similar errors and, better still, to discover some solution of our dilemma. Closer observation of pathological conditions, wider investigation of the accessory surgical field, and more exacting analysis of symptoms have thus become imperative. And to-day we are beginning to reap the fruit in the definition of other lesions which explain our former errors of diagnosis and point the way to possible rescue from despair of many of these unfortunates.

## MEMBRANOUS PERICOLITIS

In 1908 the writer presented to the Western Surgical Society some observations on certain pathological changes found about the right colon to which he applied the descriptive name "Membranous Pericolicitis," or the "Pericolic Membrane" These conclusions were the culmination of isolated individual observations of about six years The first observation was made in 1902 in a case with the following history

The patient was first seen by us when she was a probationary nurse in the University Hospital of our city several years before We were then consulted for what was supposed to be an acute exacerbation of a long-standing case of chronic appendicitis She gave the history of a number of previous attacks In each case she had suffered from pain and distress over her entire right abdomen, though more particularly referred by her to the site of the appendix In none of these attacks had she had temperature or pulse disturbances,—in fact, none of the characteristics of an acute appendicitis or peritonitis She had gone to bed, however, frequently for a day just from pain and discomfort She said that she had never felt entirely comfortable in her right side for years, but did reasonably well except when these severer "spells" came on She was a very attractive young woman in her personality, and quite intelligent, though of a decidedly high-strung temperament and somewhat neurotic She described her symptoms very freely,—in fact, was more fluent than is the average woman in portraying her complaints We found her with a normal pulse and temperature On palpation she complained of tenderness all over the right abdomen, was indeed quite hyperæsthetic There was no rectus rigidity Her greatest tenderness she located about the appendicular region in general, but we could not focalize to a finger-point We fell in quite readily, however, with a diagnosis of chronic recurrent appendicitis and recommended operation upon her recovery from this "spell" There was no suggestion of urgency. When she got up, however, still being a probationer, the superintendent of nurses decided not to accept her in training, as she considered her too neurotic to make a satisfactory nurse She therefore left the hospital, and we did not see her again for three or four years She then came to Kansas City from her home in Iowa, where she had married and then lived, to consult us again We then learned that in the interval she had been operated upon by a distinguished surgeon, whom we knew, and had had her appendix removed She obtained no relief from the operation, however, and continued to suffer as before A second operation was done and one of her ovaries removed Still no relief, and with this history she returned to us On examination, with the appendix and one ovary gone, we could find no explanation for her continued symptoms She was

therefore referred to one of our leading internists, who sent her back again, saying that the other ovary was diseased and should be removed. We could not confirm this diagnosis, but she insisted on relief, and we consented to operate on the diagnosis of our medical *confiere*. Operation disclosed the one remaining ovary perfectly healthy. A perfectly healthy broad ligament was found on the side from which the ovary had been removed. We then decided to inspect the site of the appendix. Here we found a perfectly smooth cæcum at the site where the appendix had been with not the slightest adhesion of any kind. Above the appendix, however, indeed, really above the cæcum about the colon our attention was strikingly attracted to the condition with which this paper is concerned. Here we observed what looked like an entirely complete new layer of peritoneum, perfectly transparent, investing the colon from above the cæcum to the hepatic flexure. This membrane was very loosely attached, but moved freely over what appeared to be the normal peritoneal coat of the colon beneath. This membrane appeared to come on to the colon from the outer parietal wall, into which it quietly faded away and, above the hepatic flexure of the colon, became lost in the transverse mesocolon. The membrane covered also the whole of the circumference of the colon and ereceptibly became lost in the inner side of colon and the inner parietal toneum. The whole right colon was rather closely confined in the bar fossa and could not readily be pulled forward. Likewise it seemed distinctly shortened in its long axis and at places presented a plecting, with the delicate fibrous strands of the investing membrane passing straight across from one fold to the other. It thus appeared as though the colon was restricted both as to the action of its circular and its longitudinal fibres and more or less immobilized to the posterior abdominal wall. There were no adhesions between the colon and any contiguous structure, and the membrane did not strike us as analogous to an adhesion in any sense. It looked instead as we have described, as a new adventitious, vascularized, investing layer of peritoneum. At the time of this, our first, observation it impressed us as some sort of an anatomical freak which we in no way associated in our mind with the woman's complaints. We made no attempt, therefore, to deal with the membrane in any way, and, with the simple observation of its peculiar appearance, closed up the abdomen. The patient was, of course, not improved in the least by our operation, though we were satisfied now with a diagnosis of neurasthenia, and placed her malady in her head and not in her abdomen.

In the course of years, both before and since this case, we can recall several cases of somewhat similar clinical picture in which we have operated with a diagnosis of chronic appendicitis and removed the appendix—but without the expected relief to our patient. These cases, being always considered uncomplicated chronic appendicitis, were operated with a very

small abdominal incision, and the colon was not seen at all. The real condition in these cases is as yet conjectural, as we have had no opportunity to re-operate in any of them. In the light of other demonstrated cases, however, we now have a strong suspicion that this same pericolic membrane could be found in at least several of them.

Following this interesting case, however, we operated in several cases of somewhat the same type, and with the diffused symptoms were in doubt as to whether the trouble lay in the appendix or the gall-bladder. In several such cases, in order to expose both sides through one opening, we made a free right rectus incision midway which could be enlarged in either direction as found necessary. This incision thoroughly exposes the ascending colon. In several of these operations we found both appendix and gall-bladder perfectly normal, but, to our surprise and interest, again observed this same peculiar membrane.

In review of these several observations we became convinced that herein lay a certain very absolute pathological condition of more or less frequent occurrence. We were sure that similar observations must have fallen under the eye of practically every surgeon of any considerable experience, though none, so far as we knew, had given it any special consideration in pathological description nor recognized it as a condition of any common occurrence or clinical significance. The only article bearing on this subject which had come under our attention was a brief one by our fellow-surgeon, Binnie, on "Pericolicitis Dextra," undoubtedly referring to the identical condition, but viewing these changes simply as adhesions, as doubtless had the other many observers. This general conception had led to rather cursory attention, with the general assumption of antecedent appendicitis and the hope of relief by ordinary appendectomy. In our opinion, however, we had to deal with a condition of rather more definite pathological specificity, the exact origin and nature of which should become a matter of moment.

*Pathological Description*—In 1908, at the Kansas City



General Hospital, we were fortunate enough to find a well-marked case in a patient dying of other causes, but with history of this type. This specimen was removed and submitted to careful examination by the pathologist, Dr Frank J Hall, who reported as follows:

"The specimen of ascending colon which you presented to me as a type of the pericolitis you have been interested in exhibits the following gross and microscopic features. The specimen presents the caput coli with attached appendix, the ascending colon, and a short segment of the transverse colon.

"From a point just at the hepatic flexure to three inches above the caput there spreads from the parietal margin over the external lateral margin to the internal longitudinal muscle band a thin vascular veil in which long, straight, unbranching blood-vessels course, most of which are parallel with each other and take a slightly spiral direction over the colon from the outer upper peritoneal attachment to the inner lower portion of the gut, ending just above the caput. The appendix is not implicated in any way.

"Coursing with the blood-vessels are numbers of shining, narrow bands of connective tissue which gradually broaden as they go and end in a slight, fan-shaped attachment at various points on the anterior and inner surfaces of the colon. At these points of attachment the gut is held in rigid plication.

"The entire specimen conveys to the eye the idea that an œdematous fluid lies beneath this delicate membrane and reminds one of nothing so much as an œdematous arachnoid so often encountered on removing the dura mater from the brain of a dead alcoholic. The colon seems placed in a diaphanous bag slightly too short to contain it without wrinkling. At the beginning of the hepatic flexure the drawn membrane particularly angulates the contained tissue. Here and there are spots and tags of fat beneath the cobweb. On handling the specimen the colon slips about in its bag without entire freedom as a foetus within its amniotic sac. A portion of the parietal peritoneum has been removed with the colon, and shows that the membrane and blood-vessels arise in, and are continuous with, the structures of the parietal peritoneum as it sweeps over the colon. The entire structure seems to be peritoneum, loosened from its close connection to the abdominal wall and colonic surface by some serous exudate, after which the particular vascularization and connective-tissue banding has occurred as a chronic reaction to irritative influence.

"Microscopic sections prepared from blocks of tissue cut entirely through to the lumen of the colon present, first, a very loose external covering, a normal musculature, a broad submucosa, and a normal glandular coat. Our chief interest lies in the serous coat, which is seen to have its fibres split asunder as if by serous infiltrate, thus lifting the endothelial layer of the membrane, which is clearly demonstrated to exist as a cover-

ing for all. The blood-vessels present in cross section and are unusually large and thin walled. Wherever a blood-vessel courses there also is a condensation of the white fibres into bands parallel to the vessel. The general aspect of the region under discussion is that of a mass or more or less isolated fascicles of white fibrous tissue, with here and there a blood-vessel filled with blood, broad clefts lined with endothelium, and a few fat and connective-tissue cells sprinkled here and there.

"No fibrin, polymorphonuclear leucocytes, or other evidence of inflammation are present. The connective tissue next to the layer of longitudinal muscular coat is condensed, and seems to penetrate in increased amount between the muscle bundles. Aside from this questionable matter, the gut and its walls are normal. The endothelial covering in places on the surface is perfectly preserved, and demonstrated beyond a doubt that we have here no new or false membrane, but simply a rarefied and otherwise altered natural structure. The enlargement of the endothelial-lined clefts so abundantly observed suggests a chronic lymphostasis as an associate condition, which is possibly a key to the formation of the amount of fluid in the tissue spaces of the peritoneum."

*Clinical Description*—In addition to this description we would add some observations of the condition as observed now in quite a number of living subjects seen in the course of surgical operations. The transparent, vascularized veil appearance of the membrane strikes one's attention very forcibly with bright red vessels running parallel with the long axis of the ascending colon. In some instances it appears as though the membrane came on to the colon from the lateral parietal wall just above the cæcum and courses directly upward, to disappear beneath the liver on the superior layer of the transverse mesocolon. In other instances it seems attached to the under surface of the liver well anterior to the normal peritoneal reflection. Again, in other cases, it appears as though it had begun above and descended on the colon to its termination usually just above the cæcum.

Again we have seen it pass across and upward to the transverse colon, which in one instance was apparently drawn down by the membrane, practically paralleling the ascending colon to the level of the cæcum. (In this case the gastric symptoms were marked as a result of the mechanical gastropnoia thus produced.) In one instance this membrane was so dense as to lose entirely its apparent vascularity and transparency, and

looked like a solid sheet of organized fibrous tissue, beneath which the ascending colon was so lost that it could not be seen at all until the membrane was divided and brushed aside, when an apparently normal, though contracted, colon became evident. In one instance the membrane, passing from the colon across the posterior parietal wall, went as far over as the jejunum, which was likewise completely invested for about eight inches of its distance immediately after its beginning beneath the transverse mesocolon. In this case the symptoms had been quite strikingly those of pyloric stenosis, which was the pre-operative diagnosis.

In no instance does this membrane resemble our ordinary conception of an adhesion. It is never adherent to the abdominal wall nor to any contiguous loops of small intestine. Instead, it resembles more closely than anything we can describe a thin pterygium. In recent cases the membrane is quite free and produces but limited restriction to the underlying colon. In more advanced and characteristic cases it seems to bind the colon close to the posterior abdominal wall, and produces such marked angulations and convolutions of the colon as to practically produce a stricture of its lumen. In fact, in one of these cases seen in autopsy, when a stream of water was caused to flow into the cæcum through the ileocæcal valve, the cæcum distended almost to bursting, and yet none of the fluid would pass through the ascending colon and pass the hepatic flexure until it was milked through with the fingers. It is also noteworthy that in the large majority of cases the cæcum was not involved in the membrane at all, but is found greatly distended and correspondingly thin. Nor was the appendix invested except when it occupied an ascending position at the outside of the colon, when it was covered by the membrane as it was reflected on to the colon from the lateral parietal wall. The appendix in almost every case, however, was rather small and sclerotic. We have seen the membrane in one case in which there had been years before an appendicular abscess which was drained. In this case the cæcum was likewise markedly involved in the membrane. The angulation of the

colon is generally most marked at the hepatic flexure. There is always a very loose space where the membrane can easily be picked up at the outer angle where it passes from the colon to the outer parietal wall.

*Etiology.*—The cause or origin of this condition has given rise to considerable speculation, with a number of quite diverse theories. These varied theories resolve themselves naturally into three general theories: (1) congenital, (2) mechanical, (3) inflammatory, each with certain minor differences.

1 *Congenital*.—Quite a number of observing surgeons have expressed the view that the membrane described is congenital in origin, but differ as to the exact anatomical derivation.

(a) Mayo is inclined to view this membrane as the true peritoneum, which, as the cæcum descends, failed to settle itself closely in the normal way to the gut-wall, but, remaining loose, acquired the peculiarly excessive vascularization. If this were correct, we would wonder why similar peritoneal laxity did not extend to the cæcum as well.

(b) Keiller of Galveston, in personal conversation, suggested the possibility that this membrane was a prolongation of the border of the great omentum which became attached to the ascending colon while it was still up beneath the stomach before complete rotation and was drawn down over the gut in its descent and remained as a separate layer of peritoneum. His view was suggested by the parallel arrangement of vessels as in the true omentum and the fact that it appeared so often to come on to the ascending colon from above and was practically continuous with the right border of the true omentum. This theory has recently been supported in print by Cottee of Lyons, France, who considers it as *one* of the types of membrane. In cases, such as our first and others reported (one by Pilcher), where the descending portion of the transverse colon is drawn down parallel to the ascending colon and mutually covered by this membrane (double barrel, as Gerster describes), the suggestion looks plausible. We also have recently observed a case in which

the lower portion of the usual omentum was fused with the pericolic membrane for a width of about two inches just above the ileocaecal juncture, presenting a definite band of constriction, but free above entirely

These congenital theories are attractive, and at the same time would offer the greatest encouragement to surgery. For, if such they be, a simple division of restricting bands, like tenotomy in congenital club-foot, should furnish relief, as should the method suggested by us in our original paper. However, so far we know of no observations of this condition in infancy or childhood. Furthermore, in all our cases the clinical history has been of adult origin. Perhaps, however, this can be explained by assuming that in early growth of the gut the membrane is sufficiently lax to permit freedom of peristalsis. Later on, however, as the gut grows in length or is lengthened by traction of the weight of stagnant feces, the membrane fails to stretch correspondingly, and hence begins to become a source of restriction and obstruction. Then follow the clinical phenomena.

(c) We have noted as one of the attendant conditions of our pathological picture the great dilatation, elongation, and thinning of the cæcum. As far back as 1904 Wilms of Germany called attention to a condition characterized by great motility and elongation of the cæcum, to which he applied the term "Cæcum Mobile," and to which he ascribed a chain of symptoms quite like those we have found in membranous pericolitis. This condition of the cæcum is generally congenital, and, if the symptoms in our cases are due to the condition presented by the cæcum alone, we should recognize here likewise a congenital origin. Dreyer (Breslau), however, in anatomical studies found the cæcum freely movable in as large as sixty-seven per cent of subjects, and hence questions the mobile cæcum in itself as a factor of much importance. In our observations we have been inclined to consider the enlargement of the cæcum as a secondary change, its gradual dilatation being the result of long-continued distention by gas and feces which are retained in the cæcum.

shortening of the repaired capsule. It would be difficult to calculate what its influence is under such circumstances, but it is fair to assume that it cannot be as effective in old as in recent dislocations. In reduction by the Allis principle, the capsule plays no part, except in so far as it must be torn to permit the reduction. We depend upon the strength of the humerus and, with firm fixation of the scapula, the force is applied through it to the shortened portions of the capsule. The traction is made in its long axis, and at the upper end the force, driving the head toward the socket, is applied almost directly to the bone. In the Kocher method the main force is applied to the lower end of the humerus, which represents a long lever, the fulcrum being at the attachment of the capsule to the anatomical neck. Of the four fractures produced by Kocher, three were at the upper end of the humerus. He recognized that the external rotation was the dangerous movement. This is eliminated in the abduction method.

It is generally recognized that the humeral head leaves the socket while the arm is in abduction. In the normal condition, when the scapula is fixed in its position of rest, *i e*, the position it occupies when the arm is hanging at the side of the body, the humerus reaches the limit of abduction at about a right angle with the body (Fig 2). In the dislocation when the arm is in abduction, the head is anterior to and on a slightly higher level than the socket. Therefore, to reduce, the head must first be brought down to the level of the socket so that it can be made to ride over the anterior margin of the socket, outward and backward. The traction on the abducted arm must be strong enough to overcome the resistance of the holding portions of the repaired capsule, and the traction or direct pressure outward and backward on the upper end of the humerus should not begin until the head is thought to be low enough. I know of no exact method of determining this point, but I have an assistant place the finger or thumb of one hand on the head so that he and I can observe approximately its degree of downward movement when the traction is made on the arm and the scapula is firmly fixed. I think it should move about a full inch,

membranous pericolitis. For all have seen the most stubborn and complete cases of constipation with no such pathological picture at all and oftentimes without any further clinical symptoms. We think this membrane is therefore something other than physiologic response to mechanical demand.

3 *Inflammatory*—Two general theories of the origin, based upon the assumption of inflammatory origin, have been presented, one assuming a spreading peritonitis from points of original infection *without*, and the other a reaction from infection *within* the *contiguous* gut

(a) *Without*—Undoubtedly our older views of this condition accepted it as one of true adhesion, the result of old infection transmitted from, most usually, the appendix, or, in case of particular unvolvement about the hepatic flexure, from the gall-bladder, and upon this hypothesis it was confidently expected that the simple removal of the appendix or the drainage of the gall-bladder would suffice to cure. This surgical effort has proved a failure. This failure, however, does not suffice to disprove the theory, as the "adhesions" which are the effect of the original disease may suffice to become a secondary and effective cause of their own train of symptoms, and, even though the original focus is removed, this secondary cause remaining now becomes a primary source of importance. Hertzler, who also made microscopic examination of specimens from some of our earlier cases, believes the condition one of "varicosity of the peritoneum," due to a more or less distant inflammation, and that the membrane ("pseudo-peritoneum") itself consists of peritoneum mobilized by a hyaline degeneration of the subperitoneal connective tissue. The clinical history, however, does not show in these cases any sufficient evidences of a true peritonitis originating from a focus which would produce such broad results, apparently.

(b) *From Within*—Perhaps the majority of surgical observers have held to the view that the peritoneal reaction is from infection within the colon. Gerster concludes that "the peritoneum reacts to the infectious process ordinarily associated with *chronic colitis* by the formation of character-

istic vascularized transparent membranes (pseudo-peritoneum) which take their origin along the external lateral aspects of the cæcum, ascending colon, and hepatic flexure on the one side, and the sigmoid flexure, descending colon, and splenic flexure on the other "

Pilcher, likewise, "considers them to be *the result of long-continued or oft-repeated mild infections of the peritoneal covering of the cæcum and appendix* transmitted through the intestinal wall," but does not specifically presume a colitis, as does Gerster

The pathological report of Dr Hall, quoted earlier in the paper, finds no microscopic evidences of change in the mucous or submucous coats to conform with the true colitis When we reflect that the area of gut most affected is that from which most of the *physiologic absorption* takes place in the normal tube it is not difficult to assume that through this segment mild infection and toxins may likewise pass to the peritoneum without necessarily concomitant inflammation of the mucous lining, though the latter may, and doubtless often does, coexist M L Harris is a positive advocate of the inflammatory theory, and believes that the anaerobic bacteria described by Runeberg and Keyde, which are always resident in this portion of the intestinal canal, are the specific factors in the production of the peculiar vascularizing inflammation characteristic of this pericolitis

Our personal observation of now a considerable number of cases at operation rather inclines us to the belief that perhaps varied causes may be responsible for the production of this pericolic membrane We have one case, previously reported, in which the membrane (in this case involving the entire cæcum as well) was undoubtedly the sequence of an antecedent acute peritonitis of appendicular origin This case had been one of walled-in appendicular abscess, with drainage without removal of the appendix At the time of our later operation all the walling-in adhesions were gone, but the vascular membrane was well marked This is the only one of our cases with antecedent acute appendicitis We have also seen one or two cases which strongly suggested a congenital origin



and verified a suspicion of the correctness of Keiller's (also Cotte's) omental idea. Also a few cases with alternating constipation and diarrhœa have led us to suspect a coincident colitis, as believed by Gerster. In quite the larger percentage of cases, however, we are of the opinion that the view suggested by Dr Hall is correct. This opinion is the only one thus far substantiated by microscopic study including the entire gut. We do not assume, however, that one can be dogmatic concerning the revelations of only one case of real pathologic study. Surely, however, surgery here presents a definite problem worthy of the extended studies of the pathologist, whose aid must be invoked in the solving of the question of pathogenesis, since upon this solution may rest in such large measure the correct direction of surgical effort.

*Symptomatology*—While the observation of our early cases was producing certain fixed opinions of a definite pathology, we were also, in the study of the clinical manifestations gradually, greatly impressed with certain striking similarities in the clinical histories of each. These impressions were remarked to several of our surgical colleagues, and, becoming likewise interested in the subject, they were soon able to confirm both the pathological picture and the clinical syndrome. Finally, from these repeated personal observations, and with the assurance offered by the corroborative evidence of these colleagues, we became convinced that this interesting pathological condition should be susceptible of absolute clinical diagnosis. Finally, in the early part of May, 1908, came the first case in which we attempted to make such a diagnosis before operation. This diagnosis was fully confirmed when the abdomen was opened. Between this time and that of the publication of my original paper in March, 1909, we operated upon nine cases in which this membrane was found, and in no case where such diagnosis had been made did we fail to find the corresponding pathological picture. This clinical report of several of these cases was given in detail in our original paper and will not be repeated here. These conclusions have been further confirmed by an experience in the observation of, at the present, in all, about thirty-five cases. We feel, there-

fore, that this positive pathological condition has an equally positive clinical picture. The following symptoms combined are usually sufficient to establish a definite clinical syndrome

1. *Pain*.—In every case pain has been the dominant symptom which has caused the patient to be referred to us for surgical relief, usually in the belief that the patient was suffering from appendicitis or gall-stones or, in several instances, gastric ulcer. This pain practically always has at some period a definite abrupt onset. Sometimes the pain is quite severe, sometimes no more than distinct distress. When once started the case is usually distinctively progressive in its development, though oftentimes, in the early stages, with remissions of comparative comfort for variable periods. Later the pain or discomfort is practically constant, though marked by periods of acute exacerbations ("spells"), oftentimes requiring morphine for relief. The pain is quite generally diffused over the entire right side of the abdomen, though oftentimes particularly accentuated over the cæcum and at the hepatic flexure beneath the ribs. These several attacks of pain are not, however, as a rule, attended by any elevation of temperature or by any pulse disturbance. They are rarely, if ever, referred to the epigastrium.

2 *Tenderness*.—A diffuse tenderness is likewise characteristic, but *without any attendant rectus rigidity*. This tenderness oftentimes approaches an hysterical *hyperæsthesia*, and may be such as to render the pressure of clothing quite unbearable. While, like the pain, the tenderness is diffused pretty well over the entire right side of the abdomen, particular points are frequently observed low down in the groin, at McBurney's point, and just beneath the costal margin. These particular points of tenderness generally lead the practitioner to refer the case to a surgeon with a diagnosis of either ovarian trouble, chronic appendicitis, or gall-stones—or a combination of each. The *distinctly localized* symptoms of these varied conditions, however, are lacking.

3 *Constipation*.—Constipation is marked, particularly in well-developed cases, and large doses of any cathartic are required to secure evacuation of the bowels. The thorough

emptying of the gut, however, oftentimes affords distinct but transitory relief. Castor oil usually cures for a few days. In some instances the constipation has existed long before the pains began, sometimes there was none before. It is certainly exaggerated after their onset.

4 *Bloating by Gas*—The formation of gas with much bloating is usually a marked symptom, particularly in the periods of exacerbation. This bloating is most marked in the lower abdomen, and is due to the great distention of the cæcum. It tends to grow worse and in itself causes much distress, and the patient complains much of the constriction of clothing. This gaseous distention of the cæcum is oftentimes sufficient to be apparent to the eye in inspection of the abdomen. On palpation the fulness is evident, and gurgling is readily demonstrated by manipulation with the fingers. Sometimes relief is experienced by pressure over the cæcum, as in leaning against a table or bed or lifting the lower right abdomen with the hands. Sometimes, under such manipulation, the gas can be felt to pass onward with corresponding relief. Abdominal massage properly used may give temporary relief.

5 *Mucous Diarrhœa*—In long-standing cases constipation may alternate with mucous diarrhœa. In nearly all cases some mucus will be found on examination of the stools, but is usually not sufficient to attract the attention of the patient, and the fact is only elicited on direct inquiry.

6 *Gastric Disturbances*—Disturbances of digestion are rarely absent, and are oftentimes so pronounced as to make them dominant and lead to a primary diagnosis of "chronic gastritis" or "gastric ulcer." They are not influenced by diet or even, as a rule, by fasting. They have no definite relation to the period of gastric digestion, and are only benefited by purgation, and then but for a while. The gastric analysis is likewise variable. In all, these stomach symptoms conform with what we to-day generally recognize as those of functional gastric disturbance, with the real disease elsewhere. In this connection it is well to quote from a recent address of Moynihan where he says, "In my own experience the commonest

site of a 'gastric ulcer' is in the right iliac fossa, and I have no doubt that in the majority of the cases which form the basis of the text of the very careful and elaborate treatises by the physicians of all lands upon 'gastric ulcer' no morbid process of this kind was present"

7 *Loss of Weight and Tone* —As the case progresses the patient begins to exhibit the usual signs of intestinal toxæmia, with general impairment of nutrition and vitality. He begins to lose flesh quite perceptibly, and with the loss of weight is a corresponding loss of strength and tone. He becomes weak and lacking in ambition, the skin becomes mottled and discolored, the facial expression shows depression, and the general picture of intestinal auto-intoxication is complete.

8 *Neurasthemia* —Finally, the patient becomes markedly neurasthenic and even melancholic. All symptoms are exaggerated, and it would take volumes to record their chronology of complaints. When our surgical efforts proved futile it was easy to fall back on the all-sufficient excuse, neurasthenia.

*Differential Diagnosis* —We believe a diagnosis can almost always be correctly made by a careful study of the case under the analysis of the foregoing symptoms, particularly after one has once had the experience of even a few well-observed cases. Thus far we have found little difficulty in diagnosis through the analysis of the clinical symptoms and physical examination alone. In fact, we have been able to arrive at a positive diagnosis in all well-matured cases on clinical evidence alone, and in no case in which such diagnosis had been made did we fail to find the membrane. It is, however, true that the membrane, in several instances, has been discovered in the course of abdominal work for other conditions where it had not been suspected. In none of such cases, however, was the membrane producing any mechanical interference with the free action of the colon. It is therefore apparently only productive of diagnostic signs when it has become a factor in the establishment of mechanical interference with intestinal peristalsis.

For additional evidence the use of the X-ray, following the ingestion of bismuth, has proved of considerable value, and

has been well presented by Lane, Pilcher, and others. For the technic of this use of the bismuth meal we quote as follows from Pilcher.

*“Technic of Bismuth Meal*—The bowels having been emptied during the day by a dose of castor oil, the patient is given, at ten o'clock in the evening, a mixture containing from two to four ounces of bismuth subcarbonate, the amount to be determined by the size and weight of the patient. To this are added six ounces of mucilage of acacia, and the quantity thus obtained made up to sixteen ounces by top milk, which serves to disguise the insipid taste of the bismuth and the acid taste of the acacia. The patient then reports to the radiographer the following morning at nine o'clock, after an approximate interval of twelve hours, at the end of which time it will usually be found that most of the bismuth emulsion has passed the terminal ileum and has already filled the first part of the big gut. Subsequent exposures must be determined according to the degree to which the bismuth is found to have progressed along the bowel at the first examination. In many cases a supplementary enema of bismuth is administered through a short rectal tube. Observation shows that the emulsion is carried around to the cæcum within four or five minutes by retrograde peristalsis. By combining the two methods a good demonstration of the entire intestine can be secured.”

The evidences furnished by skiagraphic work with bismuth are in general those of local stagnation in the ileocæcal region, and particularly will demonstrate the dilated and oftentimes pro-lapsed cæcum. Repeated pictures at intervals also demonstrate the retardation of the fecal current in the ileum, in the cæcum, at the hepatic flexure, or anywhere that obstruction may occur.

With the rather broad distribution of symptoms resulting from membranous periccolitis there may be quite a number of other conditions simulated and require differentiation.

1 *Chronic Appendicitis*—The most common error has arisen in diagnosing this condition as chronic appendicitis, a mistake often made, indeed. It should be remembered, however, that the appendix, as a small localized organ, should give, when inflamed, rather correspondingly definite local signs. The tenderness of chronic appendicitis can, even by the patient himself as a rule, be focalized with the finger-tips, though the exact spot must vary with the anatomical site of the appendix in the individual case. In membranous periccolitis, in marked contrast, the tenderness is diffuse as the lesion, over practically the entire right side

owing to the obstruction in the colon above, caused by the restrictions of the pericolic membrane Wilms, however, claims the existence of a symptom producing mobile cæcum without membranes, adhesions, or kinks Such must be rare in our observation

2 *Mechanical*—All are familiar with the noteworthy and frequent papers of Arbuthnot Lane of London on "Chronic Constipation" and "Chronic Intestinal Stasis" Beginning with intestinal stasis, primarily dependent upon transition in man to the erect posture with evolutionary social changes and habits favoring stasis, Mr Lane traces an extraordinarily interesting chain of sequences, both pathological and clinical Among these pathological changes he describes adhesions about the terminal ileum, appendix, ascending colon, the hepatic and splenic flexures, and the sigmoid, all of which he considers as accessory ligaments formed to antagonize the downward strain, with tendency to prolapse of these segments of the intestinal tube These adhesions, as described by Mr Lane, are intended to be conservative and protective, though he admits they sometimes go too far and become obstructive American observers have confirmed Lane's observations, practically concerning the kink (Lane's kink) near the terminus of the ileum and the adhesions (if such they be) about the ascending colon and hepatic flexure His more elaborate or extensive descriptions have not often been verified, however, in this country We are of the opinion, however, that what he has described simply as "adhesions" is, in fact, the same condition we have endeavored to present, though his observations have evidently been very lacking in descriptive significance and clarity Likewise, while simple intestinal stasis may act in some manner as a cause in the production of these "adhesions," it is the "adhesions" which produce the suffering Likewise, it may be pertinent to inquire if the "adhesions" may not, instead, be or become the cause of the stasis At all events, we are persuaded that something definitely more than chronic constipation must exist to occasion either the pathologic or the clinical picture presented by

of the almost universal presence of digestive disturbances in these colonic disorders. In pericolitis, however, the gastric symptoms present no definite type, and have no special relationship to gastric function, either in time of occurrence or in character. They are only influenced by intestinal evacuation. The present-day conception of extrinsic gastric symptoms, and reference will readily protect the careful analyst, with the presence of the other distinctive intestinal signs.

4 *Ovaries*—In women the cæcum distended and down low in the pelvis leads one to consider ovarian disease, and doubtless many ovaries have been taken out on such erroneous conclusions. Again, however, we must note the absence of focalizing limitation or association with menstrual function, and pelvic examination should clear remaining doubts.

5 *Chronic Colitis*—The term colitis as used in the past has been so all-embracing as to cover every phase of large intestinal activity, and doubtless many cases of membranous pericolitis have found refuge beneath its sheltering wing. A true colitis, however, should show more evidences of increased mucous secretion. Diarrhœa, therefore, should be largely characteristic of colitis, with abundance of mucus in the stools most of the time. In membranous pericolitis, *per contra*, diarrhœa is absolutely rare, and mucus is only observed on close attention and then fixed to the fecal mass. In the opinion of some observers, colitis is a cause of the pericolic membrane. We rather incline to doubt this, but believe that, as the result of chronic retention and irritation in the gut restricted by the pericolic membrane, a colitis may occur as a secondary condition, and, furthermore, these cases have proved in our experience most resistant to treatment.

6 *Lane's Kink*—The distinctly focal observation in the terminal ileum produced by the much-discussed Lane's kink may also be a source of confusion. When Lane's kink is found as a solitary lesion, however, the broad distribution of signs presented in membranous pericolitis is lacking. In fact, Lane's kink more nearly simulates a true chronic appendicitis, as it is likewise a distinctly localized process. It is usually referred a little lower down and more toward the middle line than the appendix, but the X-ray may be required to differentiate. The Lane's kink may, however, be associated with membranous pericolitis. When so associated it cannot at all be diagnosed in advance, but as a

possible factor should always be looked for when operation is undertaken for the broader condition

7 *Kidney Stone*—Kidney lesions, and particularly calculus, may occasionally be suggested, though such has never occurred in our cases. The urinary analysis and the X-ray findings are sufficient to dispel any doubt

One fact at least has been clearly demonstrated. In cases of any surgical doubt of diagnosis a sufficient exposure should be made to disclose the entire ascending colon, which should then be systematically explored. The small incision and the too hasty operation on too confident diagnoses have been factors which have led us into many distressing failures. If we progress no further from these studies of membranous pericolicitis than to enable us to avoid previous errors in diagnosis and correspondingly fruitless surgical efforts we shall have gained much. With this more accurate study, however, as a basis, may we not look forward to ultimate surgical achievement in cure?

*Treatment*—From what has been said as to the quite varied opinions expressed concerning the etiology of this condition, it might reasonably be inferred that the views of treatment would be equally divergent. And to one who has followed the rather extensive literature of the subject within the past year this variance becomes evident. And such is but to be expected in any new field of investigation. We are frank to confess that our own personal opinions are as yet undecided, and only with time and an honest and impersonal criticism of actual experiences can the true condition be obtained.

1 *Non-surgical Treatment*—We have, as before stated, observed this apparent membrane in several instances with relatively slight symptoms, and in these cases the membrane was evidently producing no mechanical interference with the gut activity. These observations lead us to believe that possibly some cases, particularly those in which an early diagnosis can be made, may be cured by proper treatment without resort to surgery. And particularly would this inference appear correct if we accept the view of a colitis or an over-



absorption of irritant toxic or infective material in the colon as the beginning point of the disease. Upon this presumption the logical non-surgical treatment would involve. (1) the proper drainage of the large intestine and the removal thereby of causative factors, (2) the establishment of a correct dietary to eliminate factors of fermentation, putrefaction, and irritation, (3) methods for development of normal evacuant capacity of a gut whose muscular tone is impaired or interfered with—as by massage and exercise, (4) direct medication of the colon, mainly through colonic lavage, aided by varied possible specific medicinal agents, (5) external supports to correct malpositions and obviate the stasis of gravity.

Tyrode of Boston reports a series of cases of clinical history analogous to those found in the early stages of this condition, which under systematic treatment along such lines were greatly relieved or cured. For details of such treatment we refer one interested to the complete description of Tyrode. We are particularly inclined to emphasize the importance of efforts to restore normal muscular tonicity. Cathartics, while occasionally required, are in the end only a makeshift. Correct massage of the colon to aid evacuation of the gut and at the same time to restore muscle tone is of much value. Likewise we consider valuable exercises which bring into use the abdominal muscles and render them auxiliaries to those of the intestine. In fact, we are of the opinion that the sedentary habits of modern civilization, with the negative assistance of relaxed abdominal walls on a comfortable seat in the modern closet, are potent factors in the general tendency to constipation. The relatively weak involuntary muscles of the intestinal wall were never intended to do the entire work in producing evacuation of the intestinal contents. The compressive action of the abdominal muscles must be brought to their aid, and therein lies an important element in any non-surgical treatment. Where the factor of ptosis is added, proper abdominal support, as emphasized by Franklin Martin, is obviously valuable, but should not be carried to such an extent as to interfere with the proper activity of the abdominal muscles. Hot-water flushing of the colon not only removes toxic

material and products of putrefaction, but is furthermore stimulant to correct glandular secretion and intestinal motility. We have not considered added medication of these colon flushings as of much added value, as there is so seldom much mucous discharge in typical cases.

*Surgical Treatment*—In our experience most cases have been treated for rather prolonged periods, oftentimes even for years, before surgical advice is requested. Such evidences would not lead to much enthusiasm for conservative treatment in the average case. In fact, most of our patients have progressively grown worse, even in the face of prolonged medical efforts. And, indeed, when one views the extensive pathological changes on the outer gut surface in typical cases, one could not well hope for any real curative results from any internal medication. When fully developed it is apparent to anyone who has seen a case that the cure must be mechanical and thus require some form of surgical intervention.

But here, likewise, we are confronted with considerable disagreement of surgical opinion in keeping with the divergence of pathological conception. In order to fully comprehend the situation it is well to view briefly these varied surgical procedures. Several of these procedures have been suggested for presumably quite different conditions, but, we believe, have covered conditions of membranous pericolicitis and add some information to the subject.

We have expressed the opinion that Mr. Lane has covered the same subject in large measure from a different viewpoint. Considering intestinal stasis in the colon as the starting-point of all trouble, Mr. Lane has directed his surgical efforts to the end of sidetracking the main portion of the colon and permitting a shorter and quicker outlet for intestinal waste. It is evident that in his opinion the individual would be better off without the colon altogether. His first efforts were directed, however, to a simple short-circuiting by ileocolostomy. From this he derived much benefit, but not complete satisfaction. The well-known fact of reverse peristalsis in the colon would still carry contents back into the segments which he desired to exclude. He then began the plan of

supplementing the ileo-sigmoidostomy by excision of greater or less segments of the remaining colon, and a few years ago advocated the radical excision of the entire colon from the ileocæcal juncture to the sigmoid. This radical suggestion met with little acceptance elsewhere on account of its apparent magnitude. And now Mr Lane has himself abandoned the plan on account of several instances of distressing after-effects and an excessive mortality, mainly from true adhesions. In his latest communication he has returned to the simple ileo-sigmoidostomy, now supplementing it, however, by an effort to establish a new and artificial kink above his point of anastomosis to prevent reverse peristalsis carrying the feces back to the right colon. This method has not long been used, and ultimate experience with it is yet conjectural. If it is successful in preventing reverse peristalsis, the question naturally arises, may we not pass from constipation to diarrhoea, and, if so, where are we better off? With effective cut-off of reverse peristalsis, the further question of nutrition arises, with so large a part of our food products excluded from the absorption of the first portion of the colon, and, instead, rejected promptly from the anus. In all, the method of Mr Lane has never appealed to us sufficiently to warrant our giving it a trial, though unquestionably some good and satisfactory results have been reported by Mr Lane, and also by others who have followed his lead.

For a good many years cases of various types of chronic colitis have been treated by *cæcostomy*, as recommended first by Gibson of New York, or by *appendicostomy*, a modification of Gibson's idea introduced by Weir, also of New York. Through a fistulous opening thus provided the gut could be directly treated by irrigation, supplemented with such local agencies as might be indicated. Many most satisfactory cures have been reported from such treatment. If the theory of Gerster as to the origin of the pericolic membrane from a primary chronic colitis is correct, then this might logically have a place here. In critical reviews of the results of *cæcostomy* and *appendicostomy*, however, one is struck by the rather frequent occurrence of such remarks as this: "The

patient was entirely relieved until the fistula was permitted to close, when the symptoms recurred", or "the patient will not permit the fistula to close". Is it not highly probable that these cases of supposed chronic colitis were indeed ones of pericolicitis instead? The vent which relieves tension could thus afford relief while maintained, but with the pericolic membrane still present, a recurrence of symptoms would be inevitable when the vent was closed. It is evident, hence, that a simple cæcostomy would not cure membranous pericolicitis. But if this operation were preceded by methods which would secure removal of the constricting or restricting membrane (the sequence of colitis, if this theory is correct) it might offer a logical method for curing the original colitis. While this procedure has never been adopted by us, largely alone because of the objectionable fistula, it may yet become a method worth serious consideration.

Viewing the dilated and mobile cæcum as the fundamental cause of the symptoms presenting, Wilms, years ago, suggested a *cæcoperxy* as the correct treatment. This operation was designed to fulfil two functions: (1) to elevate the prolapsed cæcum out of the pelvis, and (2) to fix it so as to prevent kinking in peristalsis and likewise to relieve tug on bowel and appendix. This procedure has been utilized in quite a considerable number of cases by Wilms and others in Germany, with approximately seventy per cent of cures. Wilms' method was to fix the cæcum in a pocket of peritoneum made just about the brim of the pelvis, into which the lower end of the cæcum was slipped. To this method, in women at least, objection has been made by a number of obstetricians on the ground that thus placed it would become the source of trouble in pregnancy from pressure of the uterus thereon, as well as by the limitation of upward lift of the cæcum, which should take place as the uterus ascends. Others have suggested instead its fixation to the anterior parietal wall. Gregor Cornell, who has followed our suggestions of stripping off the investing pericolic membrane, has left this membrane attached to the cæcum at its lower end, and twisting the membrane into

a cord has brought it through the parietal wall as a ligament of suspension

Other German surgeons, believing the dilatation rather than the mobility of the cæcum to be the productive factor, have attempted to correct the condition by *plication* of the cæcum instead, on the same principle which has prevailed in plication of other dilated organs, such as gastro-plication, for the stomach. This has really seemed more logical to us than the fixation method of Wilms, though, indeed, both might be combined.

If our view is correct, however, that the dilated cæcum was a secondary matter, the result of long-continued distention resulting from the restriction of the pericolic membrane above, we would naturally expect the results of either of these methods alone to be transitory, and that with the cause remaining a recurrence of dilation would be inevitable. We would like, therefore, to know the remote results of such measures alone before accepting them as logical surgical procedures.

We are, however, inclined to consider some such procedure a valuable step in the mechanical relief of the obstructive effect of the pericolic membrane. When this is accomplished, the secondary dilation of the cæcum should be attacked, for we believe it to be a distinct factor in the ultimate cure. We look upon the cæcum in many respects as the initial propeller in the colonic circuit. With obstruction in front, the cæcum becomes so stretched as to lose its tone and finally its function. Cannon has demonstrated that the colonic muscles in a normal condition of tonus respond to the presence of material within its lumen by the reaction of peristalsis. When, however, the tonus of the muscle is lost, as by overstretching, the peristaltic reflex disappears. The obstruction which produced the dilatation should, hence, be first overcome. Otherwise, even though cæcoplexy or cæcal plication for a while might be efficient in restoring normal tones, we would naturally expect, with the original factor still present, a recurrent dilatation with all its sequelæ.

On the other hand, with the removal of the obstruction

alone, we yet leave a dilated cæcum with deficient primary propulsion of the fecal current. Hence this method alone will likewise sometimes fail. And such has been our experience. In our original operations we limited our surgical efforts to the removal of the constricting effect of the pericolic membrane which we attempted to remove entirely. In about 75 per cent. of our efforts the result was entirely satisfactory, with complete relief. In a smaller percentage we secured benefit in part, and in a few cases no benefit whatsoever. The latter cases were usually of long standing, and the dilatation of the cæcum was well marked, with considerable bloating and oftentimes with occasional diarrhœa. Believing that the condition of the cæcum was perhaps the cause of our failure here, and recalling the experiences of Wilms and his followers, who secured about the same percentage of cures from cæcoplexy or cæcal plication alone, it occurred to us that our original efforts might be supplemented by this procedure with advantage. Of these two German methods, plication has seemed to us to be more logical. When properly done it secures a shorter length of muscle action, thereby restoring tonus and with it the initial peristalsis so necessary. This plication can be accomplished either by longitudinal reefing mattress sutures, usually one paralleling each longitudinal band, or by two or three series of transverse sutures turning in each a fold of about one-quarter inch depth. These sutures are planned to pick up the muscular coat as well as the serosa, and as material we have used linen. This combined procedure we have utilized now for nearly a year in about ten cases, and with apparently, thus far, perfect success.

One further word here may be spoken concerning the method of dealing with the obstructive membrane. Most of the surgeons who have given attention to this condition have contented themselves with simply dividing the bands at the points of particular fixation, stretching them apart and in some instances doing plastic suture to cover the resultant raw surfaces in some manner to prevent adhesions without at the same time restoring the constriction. And in general they have reported good results from this method. In our original

communication we suggested the more complete removal of the entire membrane, which is easily accomplished. Of this method the theoretical objection was offered that it would leave large raw surfaces which might invite adhesions. On likewise theoretical grounds we assumed that the remaining covering of the supposed raw surface represented an epithelial lining of lymph space which could take the place of the normal peritonæum. Since our original communication we have operated upon two cases in our clinic where other surgical conditions of the abdomen were known to coexist and were left for future operation in order to afford opportunity for observation of the effect of the colonic stripping. These two cases, when re-operated at the end of six months and one year respectively, showed no adhesions whatsoever, thus apparently justifying our theoretical assumption. The primary effort, however, is to relieve restriction, and the extent of dissection of the membrane should be governed by this necessity alone.

In some cases the angulation of the hepatic flexure is particularly marked, and the obstruction is found chiefly here. Likewise in these cases the pericolic membrane is particularly dense and extensive. In such cases particularly the suggestion of Hoffmeister is worth consideration. He has resorted to a lateral anastomosis between the ascending colon and the descending loop of the transverse colon, thus affording a new and satisfactory channel for the easy and complete emptying of the stagnant ascending colon and cæcum. Where such an object appears desirable it has occurred to us that a method similar to that of Finney's pyloroplasty applied at the hepatic flexure would be particularly adaptable. Thus far, however, we have not had occasion to try it, but expect to when a suitable case presents.

In one instance at least, reported in our original communication, the membrane was a solid sheet of fibrous tissue perfectly opaque and entirely obscuring the entire ascending colon and hepatic flexure, which could not be recognized at all until the membrane was divided and stripped away. Then we discovered a small contracted atrophied colon which we believed incapable of restored function. In this case we excised the

entire ascending colon, including the hepatic flexure, and made an anastomosis between the ileum and transverse colon, thus entirely curing our patient. Occasionally it may be necessary to repeat such a procedure.

Finally, we are of the opinion that no one method will be found applicable to all cases, and that it is well to have in mind all the varied methods enumerated. A judicious surgical selection will give better results than any one method followed as routine. In the majority of cases the removal of the obstruction of the pericolic membrane, supplemented by a cæcal plication, is our present method of choice. In more advanced cases some method of direct drainage, as by a plastic anastomosis at the hepatic flexure, will be preferable, and occasionally a more radical operation, as excision of the ascending colon, may become necessary.

In conclusion we desire to emphasize, as we did in our first article, that any surgical procedure must be followed by a vigorous after-treatment along general lines before indicated. Correction of diet, regulation of habits, muscular exercise, and abdominal massage, with colonic lavage occasionally, should be considered essential factors in restoring proper tone and function to an intestine long disabled.

Since completing the above article, a new method of short-circuiting the colon has been suggested by Dr. Frank C. Yeomans, of New York City, in the *American Journal of Surgery*, January, 1913. Yeomans makes an anastomosis between the cæcum and sigmoid (cæcosigmoidostomy). With the usual mobility of the sigmoid and the elongated cæcum, an anastomosis of this type is easily effected, as judged by his experiences in three cases. This method appeals to us as superior to that of ileosigmoidostomy as it provides free drainage to both ends of the short-circuited colon. Even should reverse peristalsis carry fecal contents back around into the cæcum, it would again drain out through the anastomosis into the sigmoid and not invite recurrence of stasis in the cæcum and ascending colon. Theoretically, we are much impressed with this technic if any short-circuiting is demanded.



# CARCINOMA OF THE PAPILLA OF VATER.

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PRIMARY carcinoma of the duodenum, while not being of sufficient rarity to be in any sense classed as a pathological curiosity, is nevertheless extremely infrequent in occurrence as compared with many other forms of cancer. Thus, Geiser reports that in a series of 5865 autopsies on *cancer patients* the duodenum was affected but 23 times, or in about 0.4 per cent. McGlinn found in going over the records of the Philadelphia General Hospital that in over 9000 autopsies there was but one instance of carcinoma of the duodenum, and Sears, in 1904, reported a carcinoma of the papilla of Vater as being the first example of that condition ever found in the autopsy room at the Boston City Hospital.

The large majority—about 70 per cent.—of all carcinomata occurring in the duodenum are located at the papilla of Vater, and possess, therefore, greater clinical interest than their relatively infrequent occurrence would indicate, owing to the great physiologic importance of this portion of the intestinal tract. So long as this region was considered a *non me tangere* from the operative stand-point, carcinomata in this locality possessed more of a purely pathological than surgical interest, but in view of the fact that within the past few years over 20 cases have been reported, in which attempts at the radical extirpation of such malignant tumors have been made, apparently followed in a few instances by permanent cure, this can no longer be considered true, and any case which has a bearing on the subject would seem worthy of report. The following case came under the writer's observation through the kindness of Dr. Theo. A. Erck, at whose request the autopsy was performed. I am indebted to him for the privilege of reporting it, and to Dr. W. H. Fritts for the clinical notes.

Mrs G, age sixty-five years. Aside from rheumatic attacks at times, patient enjoyed good health until August, 1909, when she complained of a "bilious spell," with lassitude, and severe pains in the back, gall-bladder region, and left arm, this was accompanied by distinct jaundice. Her condition improved somewhat, but in January, 1910, she had a recurrence of the same symptoms, and again in October, 1910, from which time the jaundice steadily increased until her death in May, 1911. She complained a great deal of "indigestion," and during the latter part of her life was able to eat very little, but was comparatively free from pain. In April, 1911, she went to the Hahnemann Hospital, at this time a distinct mass was palpable below the right costal margin. The surgeons at the hospital advised operation, but this she refused and returned home. From this time on she steadily went downhill, during the last week she was in a state of extreme exhaustion, and had a number of convulsions, associated with nausea and great thirst.

*Autopsy*—Body considerably emaciated, skin everywhere of a deep bronzed color. On opening the abdomen a large amount of bile-stained, ascitic fluid escaped. The liver, gall-bladder, stomach, duodenum, and pancreas were removed *en bloc*, no changes of importance were found in the other organs. The liver was rather hard and deep yellowish-brown in color. The gall-bladder was the size of a large orange, thin walled, tense. On being opened, it was found to contain perfectly clear, mucoid fluid, and a single gall-stone, about the size, shape, and color of a large olive. No trace of the cystic duct could be found, it evidently having undergone complete obliteration.

The stomach was opened by an incision along the greater curvature, which was continued through the pylorus and throughout the duodenum. Some slight difficulty was experienced in locating and passing a probe through the papilla of Vater, this was finally accomplished, however, the probe meeting with a slight resistance at the entrance to the duct. The latter was slit up throughout its entire length, using the probe as a guide. The distal portion of the common duct, just at its entrance into the duodenum, was found to be extremely constricted, the lumen being filled with soft, shaggy tissue, through which the probe had been forced. Somewhat less than 1 centimetre above the orifice, however, the duct became enormously dilated, measuring, when opened and spread out, 7 to 8 centimetres across. The lining of this portion appeared smooth and shiny, there were no stones. A marked degree of dilatation was found throughout the hepatic duct as well, and extending into its larger branches, it being possible through several of these to pass the little finger well into the substance of the liver. No trace of the entrance of the cystic duct could be discovered.

The pancreas felt very hard and nodular, and the gross diagnosis of carcinoma of that organ, with pressure on the common duct, was made. No dilatation of the duct of Wirsung could be made out macroscopically, nor were any cysts to be seen.

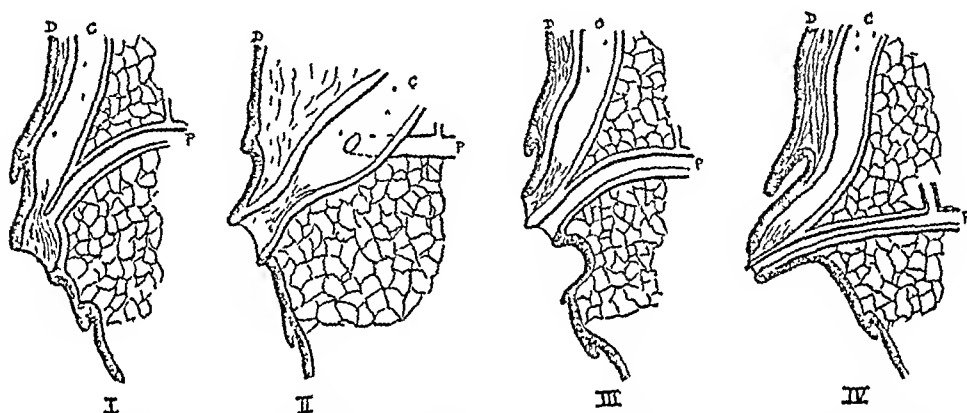
*Microscopic Examination*—Sections made from various parts of the pancreas reveal the presence of a moderately high-grade chronic pancreatitis, with some subacute inflammation as well, the pancreatic acini being separated by broad bands of connective tissue, which shows in certain areas a fairly intense round-cell infiltration. The excretory duct and its branches show some dilatation, though this does not anywhere become very pronounced. Very many of the acini likewise show a slight cystic condition, not presenting the usual appearance of practically solid groups of cells, but containing a distinct lumen, around which the cells are arranged in a band of varying thickness (Fig 3). This condition of the acini forms the most striking histologic feature of the pancreas—it exists throughout the entire organ, but is more marked in sections taken from near the head, the cystic acini decreasing markedly in numbers as the tail is approached. Nothing suggestive of malignancy is found in any of these slides, but a large section taken through the wall of the duodenum, passing directly through the papilla of Vater into the common duct and including a portion of the underlying pancreas, shows the presence of a small area of carcinoma situated exactly at the papilla, apparently arising from the duodenal mucosa. This is well shown in Fig 1, a very low-power photograph. At *A* the duodenal mucosa is entirely normal, but as the region of the papilla is reached (a small portion of the mucosa at *X* became accidentally torn off during the preparation of the tissue) the mucosa becomes markedly thickened, and under higher power presents the typical appearance of a cylindrical-cell, glandular carcinoma. The histologic picture here is that of a rather dense connective-tissue stroma, everywhere riddled with atypical, irregular, gland-like formations, exceedingly variable in size and shape, lined by fairly tall, mucoid cells, arranged for the most part in a single layer, but presenting in places a distinct multi-layered formation (Fig 2).

While by far the greater portion of the carcinomatous process is limited to the thickened intestinal wall, several scattered nests are found fairly deep in the portion of the pancreas immediately beneath this region. These present the same general characteristics as those already described, and are for the most part to be readily distinguished from the pancreatic tissue, though in places some difficulty is experienced in distinguishing some of the smaller cancer alveoli from slightly dilated and irregular pancreatic ducts, owing to the great similarity of the lining cells. Aside from this pancreatic involvement, no extension of the carcinomatous process beyond its point of origin is to be seen. The liver shows a moderately high grade of cirrhosis.

The exact point of origin of a primary carcinoma occurring in the region of the papilla of Vater is usually extremely

difficult and in many instances impossible of determination. The structures involved are extremely small in size, complex in arrangement, and their anatomic relations are by no means constant. A true *ampulla*, in the sense of a small pouch or sacculation, lying within the papilla, and receiving on the one hand the pancreatic and common ducts, and emptying on the other hand into the duodenum (Fig 4, Type I), is present, as has been shown by Letulle, in only about one-third to one-fourth of all individuals. More often one of three chief

FIG 4



Anatomic relations of the bile and pancreatic ducts at their duodenal end (after Letulle)  
D, duodenal mucosa, C, common duct, P, pancreatic duct (Wirsung)

variations is found either the pancreatic duct merely empties into the choledochus at some distance from the duodenal wall, without the formation of a true ampulla (Type II), the two ducts open side by side on the surface of the intestine, without the formation even of a papilla (Type III), or the two ducts together form a prominent papilla in the duodenal lumen, but remain separate (Type IV). Finally, the ducts occasionally empty some distance apart, bearing therefore practically no relation to each other. By no means all primary epithelial tumors of the Vaterian region arise from the duodenum proper, but theoretically at least six points of possible origin must be considered: (1) the epithelial cells lining the true ampulla, when this is present, (2) the cells lining the common duct at its lower end, (3) the cells lining the pancreatic duct at its lower end, (4) the duodenal mucosa immediately cover-

ing the papilla, (5) the glands of Brunner, situated beneath the duodenal mucosa, (6) aberrant pancreatic acini in the wall of the common duct. As will be seen by reference to Appendices A and B, tumors have actually been described as arising from each of these structures. Owing to the intimate relationships between these, however, and to the great similarity in form of the lining cells of many of them, even an exceedingly small growth may have so extended beyond its immediate point of origin that this can at best be conjectural.

In the specimen under consideration, the gradual passage of the duodenal mucosa from a normal condition into the carcinomatous area, the fact that by far the greater portion of the latter is situated in the mucosa, and the characteristic form of the carcinoma acini and of their lining cells, all indicate the origin to have been in all probability intestinal. The only other points of origin that in this case could seriously come into consideration would be the lining cells of the ampulla, and the pancreas. The latter can with reasonable certainty be excluded, for the scattered areas of carcinoma in that organ, many of them apparently lying in lymph spaces, present all the characteristics of a secondary invasion, as contrasted with the much more compact and continuous involvement of the intestinal wall. The possibility of an origin from the cells of the ampulla must, however, be admitted, though owing to the characteristics stated above, and the much greater frequency of duodenal as compared with true ampullar carcinoma, the present case must be considered as falling within the former group.

Considerable labor has been spent by various investigators in attempting to discover some histologic characteristics by which it would be possible to differentiate with certainty ampullary, ductal, and duodenal carcinomata, but these efforts have as yet been without definite result. From the practical stand-point however, such a differentiation is at best more or less a matter of hair-splitting, for the symptomatology and surgical indications of all these tumors of the Vaterian region are similar, and bear little relation to the precise group of

cells in which they have originated. It appears justifiable, therefore, to consider this group of tumors more or less as a unit, although from the strictly histogenetic stand-point some—probably the majority—should be classed as duodenal, some as biliary, and a few as pancreatic in origin.

*Etiology*—In considering the etiology of malignant growths of the papilla of Vater, the question of the gall-stone factor assumes the foreground of interest. It has been repeatedly shown that gall-stones are or have at some time been present in a large majority of cases of primary carcinoma of the gall-bladder, and, possibly to a slightly less extent, of the gall-ducts. This does not, however, appear to be the case with regard to the group of tumors which we may class as “Vaterian carcinomata,” in these gall-stones appearing—from the reported cases at least—to play a comparatively minor rôle. Thus, Schuller, in 1901, found a history of gall-stones in but 15 per cent of 41 cases of carcinoma of the papilla of Vater, and the writer, in an analysis of 110 cases from the literature, was able to find mention of stones in but 23, or about 20 per cent. Nevertheless, it must be considered highly probable that the passage of stones through the common duct must in a certain proportion of cases be an etiologic factor of great importance, especially since the papilla forms the most frequent point of incarceration, with attendant chronic irritation of the mucous surfaces. This would seem to be particularly true of the case here reported. The occurrence of a stone in the gall-bladder, the complete fibrous obliteration of the cystic duct, the very early occurrence of pain with the jaundice, the rather long intermissions between attacks at first, and especially the comparatively long interval—one and three-fourths years—elapsing between the onset of symptoms and death, all point to the probability of a primary condition of cholelithiasis with passage of stones, with secondary development of malignancy at the papilla.

*Symptomatology*—The most complete analysis of the subject of malignant disease of the duodenum—including all tumors of the papilla of Vater, no matter what their histologic

origin—as yet made is that of Geiser, who in 1906 collected 51 cases of what he calls “periampullar” carcinoma. After a fairly extensive search through the literature, I have been able to collect 58 additional cases, giving, with the one reported in this paper, a total of 110 available for analysis. In Appendix A will be found a brief synopsis of all cases (20 in number, including five already reported by Geiser) which have been subjected to radical operation, in Appendix B is a similar synopsis of the cases in which either no operation, or merely palliative one, has been performed. (For the sake of brevity, all cases without radical operation, already reported by Geiser, are omitted from Appendix B.) This list makes no pretense at being absolutely exhaustive, as a number of cases have been reported in inaugural dissertations and other sources to which I have not had access.

In analyzing these 110 cases, we find that no single symptom is common to all, not even jaundice, which, however, is naturally by far the most frequent. In four cases it is distinctly stated that jaundice was not present, in two there was very slight discoloration of the sclera or skin, hardly sufficient to be classed as icterus, and in two no mention of the subject is made, in all other instances, however, jaundice, often of a most intense type, is specifically mentioned as a prominent feature of the clinical picture. In two of the cases (Durand-Fardell,<sup>11</sup> Devic and Savy) where icterus was not present, this fact is explained by more or less extensive ulceration of the central portion of the growth, in a third case (Lannois and Courmont) there was no constriction, but rather a dilatation, of the common duct at its point of passage through the tumor, due apparently to eccentric growth of the latter.

In the vast majority of cases jaundice was gradual in onset and progressive, though in quite a number the onset was sudden, and in a considerable proportion a distinct intermittency was noted. In most of the cases in which the jaundice was intermittent, it was so only in amount, never entirely disappearing after having once become manifest, though in a few instances there was complete clearing up between attacks. This intermittency was by no means associated only with those

cases in which stones were present, indeed, one author (Rendu) thinks intermittence in jaundice is due to variations in the turgescence and vascularization of a neoplasm, and considers it characteristic for tumor of the papilla as opposed to pancreatic carcinoma, in which the jaundice is more apt to be steadily progressive, a conclusion that can hardly be considered altogether correct, however, in view of the much larger number of cases of tumor of the papilla showing progressive than intermittent jaundice. Associated with jaundice in a large number of the patients were pruritus, rapid loss of weight, anorexia, and in practically all more or less marked discoloration of the stools, amounting in many instances to complete acholia.

Next to jaundice and its associated conditions, the most frequent symptom noted was pain. This feature is not included in Geiser's tabulation, but in the fifty-nine cases collected by the writer it was present twenty-seven times, or in nearly one-half. It is described as affecting chiefly the gall-bladder and liver region in six cases, the epigastrium in nine, the abdomen in eight, the back in two, not localized in two. In cases where the pain was distinctly colicky in nature, stones were usually, but not always, present. The occurrence of colics with tumor obstruction, in the absence of stone, is explained by Stein, who reports such a case, on the theory that as the result of bile stasis, with consequent distention of the gall-bladder and ducts, sufficient irritation of the nerve endings in the mucosa is produced to set up pathologic contractions of those organs, in an attempt to empty their contents.

Of less frequently occurring symptoms, vomiting is mentioned 12 times in the entire series of 110 cases, fever likewise 12 times, intestinal hemorrhage twice, ascites 3 times. In many instances, however, the reports of cases are so meagre and incomplete that undoubtedly many symptoms were present of which no mention has been made.

*Duration*—A most important feature of malignant disease of the papilla of Vater, from the clinical stand-point, is the rapidity with which it usually proceeds to a fatal termination. Of 47 cases, in which the time elapsing between the



onset of noticeable symptoms and death is given with sufficient accuracy to be available, the average duration was but  $7\frac{1}{3}$  months, the longest time reported was 3 years, in Mayo Robson's case, and there were but 3 others over  $1\frac{1}{2}$  years. In one of these (Herrick,  $2\frac{1}{4}$  years), the histologic diagnosis of the tumor was not carcinoma but "adenofibroma"; in the second (Morian,  $1\frac{3}{4}$  years), obstruction was relieved comparatively early by a cholecystenterostomy, and in the third (the author's,  $1\frac{3}{4}$  years), it seems probable that the earlier symptoms may have been due to gall-stones, rather than to the tumor. The extreme rapidity with which tumor of the papilla can produce death is shown further by the fact that of the 47 cases, in 23—practically 50 per cent—the duration was 6 months or less, and in 10 it was under 3 months.

A second feature of great clinical importance is that in the majority of cases death ensues before metastasis or extension of the malignant process has occurred, in other words, while the condition is still, potentially at least, *surgical*. The views of different authors upon this subject are extraordinarily at variance, probably dependent upon each man's individual experience with a very small number of cases. Thus, Oehler says that tumors of the papilla possess marked tendency to metastasize, especially the adenocarcinoma types, Schuller, on the other hand, thinks that this rarely occurs, owing to rapid death of the patient; Geiser believes that the tendency to form metastases is very great, while Letulle and Kausch consider it slight. Examining the 110 reported cases from this stand-point, we find the occurrence of metastases noted 25 times, or in about 22 per cent, in a few additional instances a limited amount of direct extension to the connective tissue lying between the duodenum and the pancreas, or to the pancreas itself, was present. In over three-fourths of the cases, however, the growth was limited to the papilla and its immediate surroundings, death occurring apparently as a result chiefly of interference with the flow of bile, and not as a result of malignancy *per se*.

A feature common to nearly all these tumors is their small size. Oesterreich mentions a growth at the papilla the size

of a small apple, Stein one of 5 cm diameter, Lannois and Courmont one the size of a 5-franc piece, Martha one as large as the fist, but aside from these, and a very few others, practically all the tumors recorded are small, being compared by their reporters to a pea, bean, cherry, small nut, etc. In other words, it is evident that in the large majority of cases, a malignant growth at the papilla of Vater leads to the death of the individual before it has had time to reach any considerable size, or to become disseminated throughout the body. If subjected, therefore, to prompt and radical surgical attack, the condition should in a fair percentage of cases be curable, notwithstanding the great technical difficulties to be overcome.

*Diagnosis*—The positive diagnosis of carcinoma at the papilla is a matter of great difficulty, and has comparatively seldom been made before operation or autopsy. There is, as has been shown, no pathognomonic or even any constantly recurring symptom associated with it. The conditions with which it is most likely to be confused are obstruction of the common duct by stone, benign stenosis from scar formation, chronic interstitial pancreatitis, and cancer of the head of the pancreas.

Where a definite swelling can be palpated in the gall-bladder region, associated with jaundice, rapid wasting, acholic stools, etc., presumptive evidence is furnished against stone and in favor of malignant disease, either at the papilla, or in the common or hepatic duct, as was originally pointed out by Courvoisier. It is impossible to say, however, in how many of the cases of tumor of the papilla this diagnostic aid was to be elicited, in comparatively few of the reports is any mention made of the presence of a palpable mass in this region during life. In almost every instance, however, very decided dilatation of the gall-bladder and common duct was found upon opening the abdomen at operation or autopsy, most of the few exceptions being cases in which there was perforation of the gall-bladder, with resulting collapse. In the majority of cases the degree of dilatation attained by the common duct is most striking, as in the author's specimen, where the duct measured, opened out, 8 centimetres across, a few cases of

even somewhat greater enlargement are on record. One would hardly believe that such extreme degrees of dilatation of this canal could take place in the short space of time elapsing, in many instances, between the onset of symptoms and death, but yet, while unquestionably the onset of symptoms may by no means be coincident with the beginning of the tumor formation, it does not seem probable that the common duct would undergo much dilatation until the tumor had reached a size sufficient to cause constriction of the lumen and produce marked damming back of the bile, at which time jaundice would begin to make its appearance. It seems probable, therefore, that the common duct is capable of undergoing rather rapid dilatation to many times its normal size.

An interesting and somewhat anomalous condition, which has been observed by a number of writers, is that of a much dilated gall-bladder and common duct, both filled with perfectly clear fluid, with *patulous cystic and hepatic ducts*, and obstruction at the papilla of Vater. A case of this kind has been carefully studied by Kausch<sup>26</sup>. At operation upon a patient with steadily increasing jaundice, the gall-bladder and common duct were found enormously distended with clear fluid, a cholecystostomy was performed, and for two hours clear fluid flowed from the tube. Then the discharge began to be slightly colored, and by the end of six hours it had assumed the appearance of somewhat pale bile, large quantities of which continued to flow as long as the sinus was left open. At autopsy, some weeks later, a small tumor was found at the papilla of Vater. Kausch thinks that the hydrops in these cases is due to excessive secretion by the mucosa of the gall-bladder and ducts, whereby, the duodenal opening being occluded, the pressure in the biliary system is so raised that the bile secreted by the liver cells is poured, not into the excretory ducts but back into the blood and lymph vessels of the liver. It is evident that the liver cells have not ceased to functionate, for had such been the case the jaundice would have disappeared, and the flow from the gall-bladder would not have become bile colored within a couple of hours after the pressure was relieved. Similar cases have been reported

by Lenormant, who agrees entirely with Kausch as to the mechanism of their production, by Ainspenger, Carnot and Harvier, Dominici, Halsted, Hanot,<sup>20</sup> Martha, Oppenheimer, Riedel, and Berg, in the last named the obstruction was due not to a tumor but to a stone, associated with infection of the biliary passages. The occasional occurrence of such cases is of importance from the operative stand-point, as they show that the mere fact of finding a gall-bladder filled with clear fluid is no proof of the occlusion of the cystic duct.

*Pancreatic Changes*—The most frequent changes observed in the pancreas as a result of occlusion at the papilla of Vater—aside from the occasional direct extension of the tumor into the pancreatic tissue—are dilatation of the ducts, atrophy of the acini, and overgrowth of connective tissue. Dilatation of the ducts is, as a rule, moderate in amount, often only to be detected microscopically, and practically never reaching a degree comparable to that of the common bile-duct. Weir speaks of a cystic cavity the size of an egg in the head of the pancreas, representing a dilated duct, but this is decidedly an exception. I have not found in any of the reports mention of a widely disseminated microcystic condition of the pancreatic acini, such as was present in the case reported at the beginning of this paper (Fig. 3), though it would seem that such a condition would be a frequent result of partial obstruction of the main excretory duct.

It is remarkable that with the high degree of pancreatic atrophy and fibrosis frequently reported, in only one case—that of Schuller—was glycosuria mentioned as a prominent feature, and even in this instance it did not persist throughout the entire course of the disease. Rolleston, among others, calls especial attention to this fact. In his case many of the pancreatic ducts were dilated and contained calculi, and there was very advanced fibrosis, but no glycosuria. While undoubtedly in many of the reported cases no test for sugar was made, in by far the larger majority it is distinctly stated that this examination was carried out, and was found negative.

*Treatment*—The only rational treatment for carcinoma of the papilla of Vater is radical extirpation, if this can be car-

ried out It has been attempted, as has been said, in about 20 reported cases (Appendix A), with, it must be admitted, not very brilliant results so far In these 20 cases, there were 8 primary deaths, and 12 patients recovered from the immediate effects of the operation Of the latter, 5 are reported as subsequently dying, in 2 cases no data are given beyond the fact that primary recovery took place, and of the remaining 5, two are reported as well 7 months after operation, one 10 months, one 2 years, and one  $3\frac{3}{4}$  years As in all forms of cinoma, early diagnosis is the *sine qua non*, but this is specially true in the type under consideration, owing to the rapidity with which a fatal termination may ensue On the other hand, however, there is perhaps scarcely any form of malignant disease which so early sends out warning signals as that producing obstruction to the bile-ducts, signals that as a rule make themselves manifest while yet the growth is small, localized, and comparatively accessible

In 14 of the reported 20 radical operations, the duodenum was opened by a longitudinal or transverse incision, and the growth, with a small amount of surrounding healthy tissue, excised, the bile- and pancreatic ducts being cut through, and then reimplanted into the duodenal wall In one case the duodenum was opened, the growth simply cuetted away, and the site cauterized, while in the remaining five cases resection of a portion of the duodenum was performed Several authors advocate a two-stage operation, believing that the obstructive symptoms (cholæmia, etc ) should be relieved by a less serious procedure than radical extirpation of the tumor, which the patients are rarely in a condition to stand satisfactorily, this to be followed subsequently by the radical operation Procedures of this sort have been reported by Mayo and Kausch, in the former's case the first operation was a cholecystostomy, in the latter's, cholecystenterostomy, in both instances primary recovery took place For the first operation, Kausch does not favor simple cholecystostomy with drainage, for while this relieves the cholæmia it causes too great a loss of important body fluids, he considers, therefore, a cholecystenterostomy the operation of choice for the first sitting, believing that this,

by conducting the bile and in some instances the pancreatic juice as well back into the intestine, places the patient in better condition to withstand the more serious operation later on

*Conclusions* —1 Carcinoma of the papilla of Vater, while by no means a frequently occurring condition, has been reported often enough to be of considerable clinical importance

2 It may arise from one of several groups of cells, the exact point of origin having, however, little effect on the symptomatology, clinical course, or surgical indications

3 The duration of the disease is comparatively short, the average time elapsing between the onset of symptoms and death being about seven months, and in many cases less than three months

4 In most cases death results from cholæmia before metastasis or invasion of surrounding organs by the tumor has occurred

5 Radical extirpation is technically possible, and if undertaken early enough should lead to a fair percentage of cures

NOTE —Since the completion of the above, two additional cases of radical operation have been reported, one by Upcott (*ANN SURG*, Nov, 1912), and the other by Slajner (*Zentralbl f Chir*, 1912, xxxix, 259, also reviewed at some length in a recent article by Kausch, *Beitr f klin Chir*, 1912, lxxviii, 439) Upcott's case was a male, aged sixty-five years. The oval tumor, about the size of an olive, was removed through a transverse incision in the anterior duodenal wall, the edges of the common duct being then sutured to the duodenal mucosa. The patient recovered, but too short a time has elapsed to say anything of the ultimate result. Microscopically the tumor proved to be a columnar-cell adenocarcinoma.

Slajner's case was a male, aged forty-eight years. The small tumor was removed through a longitudinal incision in the anterior duodenal wall. The common and pancreatic ducts were then sutured to the duodenal mucosa. The patient died 36 hours later in collapse, with cholæmic hemorrhage. Microscopically the growth showed adenocarcinoma, arising from glands at the mouth of the papilla.

## APPENDIX A

*Cases of Carcinoma at the Papilla of Vater which have been Subjected to Radical Operation*

The following abbreviations are used throughout Appendices A and B Gbl—Gall-bladder, Com d—Common bile-duct, Pan d—Pancreatic duct (Wirsung), Pap V—Papilla of Vater, Dur—Duration of disease, from onset of first symptoms to death (or operation), Op.—Operation, †—Death

ARNSPERGER <sup>1</sup> Case 28 F, 43 Increasing jaundice for 6 weeks, gbl palpable Op (Voelcker) Gbl distended, one stone size of a hen's egg Nodule size of a walnut palpable in duod at pap V Transverse incision of duod, tumor dissected out from surrounding tissue, 4 cm of com d resected Cut ends of com and pan d implanted in duod wall, duod incision closed † 2d day from hemorrhage (probably from pancreatic wound)

CORDUA <sup>2</sup> F, 41 Jaundice, gbl palpable Op Carcinoma size of a 10-Pfg piece found at pap V and excised Com d sutured to post wall of duod, duodenal incision closed Cholecystectomy Gastro-enterostomy Patient recovered, and gained in weight

HALSTED <sup>3</sup> Case 2 F, 60 Jaundice, pruritus Op Gbl and ducts greatly dilated, contained sand and clear fluid Hard body felt at pap V A portion of the duod, with  $\frac{3}{4}$  inch of the com d, and a shorter piece of the pan d, resected, end-to-end anastomosis Com and pan d implanted into duod along line of suture Recovery, 3 mos later 2d op Anastomosis between duod and gbl † Few mos later Autopsy carcinoma had recurred in duod and head of pancreas

HARTMANN <sup>22</sup> Case 1 M, 60 Progressive jaundice, one slight remission Op (Navarro) Gbl found dilated, com d size of thumb Induration felt at pap V Gbl aspirated, duod opened Tumor size of a pea found at pap V Circular incision around this, cutting com d 2 cm and pan d 1 cm above tumor The two ducts then sutured together, and into intestinal wall Patient recovered, well and strong two years later Micr carcinoma, arising from ampulla

Case 2 Jaundice for 3 weeks, gbl palpable Op (Cunéo) Gbl and ducts found dilated Circumscribed nodule felt at pap V Duod accidentally torn, opening enlarged, and a firm mass size of an almond seen in Vaterian region, projecting into duod lumen Lozenge-shaped incision around this, removing it, and cutting through pancreatic tissue Com d sutured into upper portion of duod incision, lower portion closed, middle portion left open, and cut surface of pancreas brought into it Posterior gastro-enterostomy † 5th day Micr carcinoma, arising from terminal portion of com d

HOTZ <sup>24</sup> (also OPPENHEIMER <sup>25</sup>) F, 61 Progressive jaundice for 7 months, pruritus, pains in gastric region Op (Hotz) Gbl and ducts found distended Tumor 5 cm in length felt at opening of com d into duod Post gastro-enterostomy, then longitudinal incision in ant duod wall Papilla found enlarged to a mass size of thumb, this was pulled

forward, and incised around the base, com and pand dissected free for about 4 cm, then cut across. Cut edges of these sutured to duod mucosa, incision in duod closed. Patient well and able to work 7 mos later. Micr adenocarcinoma, arising from lower end of com d.

KAUSCH <sup>25</sup> M, 49 Jaundice for 6 weeks. Op Gbl size of fist nodule size of a pea palpable at pap V. Cholecystenterostomy and entero-anastomosis. Jaundice disappeared. Two mos later 2d op Gastroenterostomy, closure of pylorus. Duod then shelled out from above downward, piece of the pancreas size of a walnut resected, cutting through pand in substance of pancreas. Duod cut through at junction of pars inferior and descendens, cut end of remaining duod drawn like a cap over cut surface of pancreas, and held by catgut sutures, the com d also being brought into duod lumen. Recovery, 7 9 mos later from cholangitis.

KORTE <sup>28</sup> F, 44 Jaundice, colicky pains. Op Gbl and com d both found enlarged, no stone. Duod incised, tumor size of a small cherry found blocking exit of com and pand. Tumor and surrounding mucosa excised, com and pand sutured to duod wall. † 8th day. Micr adenocarcinoma.

KORTE <sup>29</sup> F, 52 Jaundice, pains, fever, malaise for 14 weeks. Op Gbl and ducts much enlarged, contained pus. Induration and stenosis felt at opening of com d into duod, but no tumor. Duod incised, the stenosed com d opening slit up, com and pand drained. Patient well for 1½ yrs, then jaundice returned. 2d op Hard nodule size of a bean felt at mouth of com d. Circular resection of duod, with end-to-end anastomosis. Com and pand cut through, sutured together, and then into post duod wall. † 3d day. Micr adenocarcinoma.

KORTE <sup>30</sup> Case 32 F, 47 Jaundice for several months, pruritus; palpable tumor in liver region. Came to hospital on account of fracture of tibia. Op Gbl and ducts found much dilated, contained thick sand, but no stone. Longitudinal incision of duod, hard tumor size of little finger at pap V. Tumor excised, com d sutured to duod mucosa. Patient well 3¾ yrs later. Micr carcinoma of terminal portion of the com d.

MAYO <sup>31</sup> F, 59 For many years sudden attacks of pain in epigastric region, lasting several hours, and ending with vomiting, sometimes jaundiced during these attacks. For 1 yr loss of weight and appetite, moderate jaundice. Op Gbl enlarged, contained one stone size of a pea. Com and cystic ducts moderately dilated. Cholecystectomy, jaundice disappeared, but stools remained acholic. Three mos later 2d op Hard mass size of a filbert felt through duod wall at end of com d. Incision in ant duod wall, exposing a grayish-white mass limited to pap V. Excised, raw surface cauterized. Duod closed. Recover. Micr cylindrical-cell carcinoma.

In a subsequent paper, the Mayos<sup>32</sup> state that they "have had several examples of primary carcinoma at the pap V, with two primarily successful excisions, but no case has lived beyond 3 years."

MAYO-ROBSON <sup>32</sup> Case 536 M, 30 Three years previous, moderate pain and jaundice for 4 weeks, 3 mos later pain again, but no jaundice. Since then several attacks of pain, without jaundice. Op



which had evidently started in region of pap V, found involving inner portion of duod, whence it had extended to pylorus and head of pancreas. In separating adhesions a perforation of duod discovered which could not well be closed, portion of duod and pylorus resected, duod and stomach united by sutures. As it was clear that the com d would be obstructed, gbl drained, with view to subsequent cholecystenterostomy. † Few days later.

MORIAN <sup>45</sup> Case 4 Sudden onset of jaundice, pruritus. Op Gbl found distended, com d size of thumb. Tumor size of hazel-nut felt at pap V. Cholecystenterostomy, then longitudinal incision in ant duod wall. Circular incision around tumor, com and pand cut through, tumor mass removed, both ducts sutured into duod wall. Incision in duod closed. Recovery, 10 mos later patient apparently well, had gained over 20 lbs, and was able to do ordinary housework. Micr carcinoma.

OEHLER <sup>46</sup> F, 60 Pains in gastric region, jaundice, pruritus. Gbl palpable as pear-shaped mass. Dur 5 mos. Op (Kraske) Gbl incised and emptied. Com d found distended, incised. No stone, but obstruction felt at pap V. Transverse incision in ant duod wall, a hard, papillary tumor, slightly ulcerated, size of a hazel-nut, found completely surrounding opening of com d. Tumor excised, keeping well in healthy tissue, bed cauterized. Com d and duod sutured together, duod and com d incisions closed. No metastases found. Recovery. Micr adenocarcinoma, arising from duod mucosa.

OPPENHEIMER <sup>47</sup> F, 63 Jaundice and gastric pain for 3 mos. Op (Enderlin) Gbl and cystic duct distended with clear fluid. Hard nodule size of a hazel-nut felt in region of head of pancreas, and a gland size of a cherry, at junction of cystic and hepatic ducts. Com d incised, stenosis found at pap V and cut through. A circumscribed tumor found adherent to duod wall and pancreas. Whole of com d and surrounding indurated area resected, hepatic duct sutured to duod, cholecystectomy. Stump of pand, which had also been cut through, sunk in duod wall. Micr adenoma, arising from gall-ducts. Recovery, in 1 mo patient had gained 15 lbs. † 1 yr later from recurrence in liver.

RIEDEL <sup>48</sup> F, 50 For 9 months sharp attacks of pain in upper abdomen, for 6 months progressive jaundice. Op Gbl and ducts found much dilated, and filled with clear fluid. A yellowish-white tumor, size of a hazel-nut, at pap V. Com and pand cut through, duod resected, and the two ducts sutured into duod wall. † Same day from shock (advanced pulm tbc).

RANSFORD <sup>49</sup> F, 33 Jaundice for 4 months, sudden onset. Op Mass felt in region of papilla, duod opened by longitudinal incision, and a portion of the mass removed. Field of operation immediately flooded with bile. Duod incision closed, gbl drained. Micr adenocarcinoma. One month later 2d op. Remainder of the little tumor excised, with adjacent portion of duod, 1½ inch of com d, and 2 enlarged retroperitoneal lymph-nodes. Patient well for 8 months, then jaundice recurred. 3d op Cholecystenterostomy. † 4 mos later.

SCHILLER (also ARNSPERGER,<sup>1</sup> Case 27) Case 1 M, 66 Progressive jaundice for 6 months; chills, fever, glycosuria, which, however, only

lasted 4 weeks Op (Czerny) Icteric ascites Gbl contained 150 cc mucopurulent fluid, aspirated A hard body size of a date-seed felt at pap V Longitudinal incision in ant duod wall, the little tumor, which appeared ulcerated, seized with forceps and drawn forward Circular incision around it removing it in 3 pieces Cut end of com d sutured to edge of duod mucosa, tube placed in gbl, duod incision closed 7 5th day from sepsis Micr adenocarcinoma, arising from com d, duod, or pancreas (?) Metastases in liver

STEIN <sup>61</sup> F, 37 Attacks of pain in gastric region, vomiting, jaundice, with free intervals Palpable, tender tumor in gbl region Op Gbl much dilated, com d size of small intestine Duod opened, an area of 5 sq cm on post wall found covered by a soft, friable, papillary tumor mass, surrounding pap V This curetted away, and site cauterized Duod closed Patient recovered, and was well 7 mos later Growth considered a benign adenomatous proliferation of mucosa

VERHOOGEN <sup>62</sup> F, 33 Sudden onset of jaundice, pain in right hypochondrium, vomiting Dur 8 months Op Gbl size of a pear, no stones Incision in ant duod wall Little soft, fungoid tumor found covering pap V, resected, com d sutured to duod mucosa 7 10th day Micr glandular elements without atypical formation, "hence adenoma"

#### APPENDIX B

##### *Cases of Carcinoma at the Papilla of Vater without Radical Operation*

ARNSPERGER <sup>1</sup> Case 30 M, 56 For 1¼ yrs jaundice in varying degree Gbl enlarged, many small stones Com d dilated, head of pancreas hard, size of an egg Cholecystenterostomy 7 12th day Autopsy stenosis at pap V Micr scirrhous carcinoma of pap V

AVEZOU <sup>2</sup> M, 72 Intense jaundice, with slight remissions, pruritus, constipation Gbl size of child's fist, com d size of index-finger A circular, fungoid plaque, with raised edges, size of a 2-sou piece, found in duod at level of pap V, not, however, completely occluding orifice of com d Pancreas hard, no carcinoma Dur 8 mos

CADE and LERICHE <sup>4</sup> M, 46 Intense jaundice, occult blood in stools Cholecystogastrostomy, 11 days later gastro-enterostomy, 5 weeks later exploratory op, † 4th day after Gbl much dilated, com d size index-finger Hard nodule size of a walnut on pancreatic edge of duod at level of pap V Pancreas hard, prob neoplastic Dur 6 mos

CARNOT and HARVIER <sup>5</sup> Severe, progressive jaundice, pain in epigastric region Watery fluid in gbl Projecting from pap V a tuft of long, delicate villousities, attached to a neoplasm developed in lower end of pand Micr carcinoma, originating from epith cells of gland presenting toward the lumen a villous, deeper an adenocarcinomatous structure

COATS and FINLAYSON <sup>6</sup> M, 48 Intense jaundice, sudden, severe pain in region of gbl 1 wk. before death Gbl greatly distended and perforated, com d 1¾ inches in diam At terminal portion of com d a soft, prominent mass, partly ulcerated Micr carcinoma, arising from com d, duod mucosa not affected Dur 10 mos

DEVIC and SAVY <sup>9</sup> M, 52 No jaundice Umbilical pain after eating, vomiting Gastro-enterostomy, † 36 hrs later Gbl not distended, several stones Com d size of a lead pencil Annular tumor in duod, beginning 4 cm from pylorus, and extending for 14 cm Oldest portion apparently corresponds to site of pap V Micr encephaloid cancer, with superficial ulceration arising from intestinal mucosa Pancreas normal, but surrounded by a mass of neoplastic glands Dur 4 mos

DOMINICI <sup>10</sup> M, 70 Progressive jaundice, hiccough, tenderness in gbl region Gbl and all ducts distended, filled with clear mucoid fluid A cone-shaped mass, 1 cm in diam at the base, and 1.5 cm high, found projecting from pap V Micr cylindrical-cell carcinoma, arising from ampulla, com d, and pan d Pancreas dilatation of many ramifications of the ducts, irregularly disseminated atrophy of the acini, interstitial sclerosis Dur 6 mos

DURAND-FARDEL <sup>12</sup> M, 58 Sudden onset of jaundice, then progressive Gbl enormously dilated, walls thick Com d forms a pouch 2 cm in diam where it joins the duod, size of little finger above this A round, hard, whitish mass, size of a cherry-stone, found projecting into com d exactly at the point where this enters the intestinal wall Micr cylindrical-cell carcinoma, arising from the surface epithelium of the "canal ampullaire" Dur 6 mos (This case is considered by Bard a cancer of the pancreas, by Rendu an intestinal cancer, by Hanot a cancer "pancréatico-biliaire," and by Durand-Fardel himself a primary cancer of the bile-ducts)

EDES <sup>14</sup> F, 48 Sudden onset of jaundice Gbl enlarged, many whitish stones Com d enormously dilated to within 2 inches of duod, where an abrupt narrowing takes place, a small lymph-node found pressing on wall of com d at this point No definite mass discernible macroscopically at pap V Micr carcinoma of pap V at orifice of com d, lymph-gland secondarily involved Dur 16 mos

ELOESSER <sup>15</sup> M, 56 Intermittent jaundice Gbl moderately enlarged, walls thin, few mulberry stones Cholecystenterostomy, † 13th day in collapse. Com d dilated An indurated mass projects into duod at orifice of com d Micr carcinoma, arising either from duod mucosa, lower portion of com d, or an accessory pancreas (The author considers aberrant pancreatic acini in the wall of the com d the most probable source of origin, but does not bring forward any very convincing reasons for this belief)

ELA <sup>16</sup> M, 53 Progressive jaundice, fever, pain and tenderness over liver Gbl and com d greatly distended, filled with whitish, puriform fluid Cholecystostomy, † 10th day from hemorrhage A little nodular tumor, 11 × 9 mm, at mouth of com d, completely surrounding it, and narrowing the lumen Micr cylindrical-cell carcinoma, arising from com d Pancreas interstitial pancreatitis Dur 4 mos

HALL <sup>18</sup> M, 46 Intense jaundice, fever Gbl dilated, thin, pale bile Com d size of little finger At pap V, beneath duod mucosa, a mass size and shape of a small bean, surrounding entire lumen of com d, but not invading the deeper structures Dur 5 mos

HANOT <sup>20</sup> M, 40 Progressive jaundice, with slight remissions,

of the abdomen. It cannot be covered with the finger or even the hand, but the patient, in endeavoring to signify the site of pain, passes his fingers from costal margin to Poupart's ligament. It is true that he will usually in time find spots of rather exaggerated tenderness, as at McBurney's point, due to the distention of cæcum, and beneath the costal margin where is found the hepatic flexure as well as the gall-bladder. But these are not distinctly focal points of focal disease. An attack of acute appendicitis with diffuse peritonitis leaving behind extensive adhesions might produce similar signs of diffuse pain and tenderness, but in membranous pericolicitis there is never any history of such antecedent acute appendicitis, no fever, no rigidity, no tumor, no prolonged acute bed illness. Furthermore, in the true chronic appendicitis the pain is in most instances referred to the epigastrium, and the local signs of appendicitis become well marked only when the inflammation is sufficiently acute to extend to the peritoneum. In membranous pericolicitis the pain is always distinctly confined to the right side of the abdomen, and is never epigastric. There may be many stomach disturbances, but rarely gastric pain. This significance of epigastric pain in chronic appendicitis is indeed noteworthy. Stanton, in the analysis of end results in a traced series of one hundred cases operated upon for presumably chronic appendicitis, remarks, "in our cured cases of chronic appendicitis the pain has been almost constantly referred to the epigastric or mid-abdominal rather than to the right inguinal region. On the other hand, nearly all the patients not benefited by operation complained of right inguinal pain as one of the chief symptoms."

2 *Gall-bladder*.—The diagnosis of gall-bladder disease has also been one of the sources of error. The marked angulation of the hepatic flexure and the pain occasioned as intestinal contents attempt to pass this point of narrowing suffice to explain the confusing symptoms. Of course, there is no jaundice and no true biliary colic. But even so these signs may be lacking in true gall-stone disease. But the one significant point is the absence of distinct localized exclusive pain or tenderness beneath the ninth costal margin, which should be distinctly focal in cholecystitis, but is diffuse in pericolicitis, also, there is seldom transmitted subscapular pain in this condition.

3 *Gastric Ulcer*.—The diagnosis of gastric ulcer has also been made, and, indeed, often strongly claims one's attention, in vic-

cent years The cicatricial contraction at the site of the capsule tear in the axilla will be more unyielding after the reduction of the old dislocations than after the reduction of the recent He had, in a considerable number of cases of the latter variety, broken up this resistance by forcible manipulations under ether, without trouble and with very satisfactory results

He had had very little experience with recent dislocations, since these are usually reduced by the family physician or the hospital interne, so that in discussing the abduction method he had confined himself to the old dislocations

The superiority of the abduction method should be more evident in the reduction of dislocations of the shoulder associated with fracture of the surgical neck of the humerus, just as the Allis method is superior to the Bigelow method in the corresponding condition at the hip The Kocher method may have the advantage in the reduction of recent dislocations, without an anæsthetic, in very powerful individuals Such patients can resist more effectively the simple, direct pull in abduction than a series of more or less complicated movements as in the Kocher method, although the general spasm may effectively resist all these

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*Stated Meeting held November 4, 1912*

DR GWILYM G DAVIS, President, in the Chair

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#### STAB-WOUND OF THE HEART, RECOVERY AFTER SUTURE

DR CHARLES F MITCHELL presented a colored man, 59 years of age, who was brought to the Pennsylvania Hospital by the patrol at 5 P M, July 30, 1912, having received a stab-wound of the left chest a short while before He had been drinking heavily, and there was a marked odor of alcohol on his breath His previous history was negative, except that he always used alcohol to excess He was admitted to the service of Dr Richard H Harte, in whose absence Dr Mitchell was called upon

On admission temperature was normal, pulse 90 to the minute, while breathing was rapid and rather labored There was no sweating, lips and conjunctiva blanched, heart sounds regular, but rather faint Arteries atheiomaticous, marked arcus senilis Area of cardiac dulness not increased Right chest normal, but signs of pneumothorax over whole left chest There was some

- At operation a tumor felt on post wall of duod at pap V, resembling male nipple, head of pancreas also hard and nodular Considered a neoplasm of pap V, which had invaded pancreas Recovery, † 1¼ yrs later with signs of general metastasis Dur 1¼ years
- OESTERREICH " M, 39 Intense jaundice Gbl and com d much dilated Tumor at pap V size of a small apple Micr cylindrical-cell carcinoma A few metastases on surface of liver and in coeliac glands
- RENDU " M, 53 Intermittent jaundice, epigastric pain, fever, headache Gbl enlarged, filled with mucus, cystic duct obliterated Com d 3 cm in circumference, contains bile and pus Exactly at position of pap V a plaque 3.5 × 2 cm, slightly elevated above the intestinal mucosa Micr cylindrical-cell carcinoma, resembling those of intestinal origin, does not extend beyond submucosa Small metastatic nodule in liver Dur 4½ mos
- ROLLESTON " M, 66 Jaundice, pruritus Gbl and all ducts greatly dilated, com d size of thumb Flat growth found limited to pap V, occluding the orifices of the com and pand Micr columnar-cell carcinoma, invading the smooth muscle tissue around the pap V Pancreas fibrosis, ducts dilated Dur 11 weeks
- SEARS " M, 49 Progressive jaundice, pruritus, constipation Patient had had an attack of catarrhal jaundice 18 years before At operation gbl found distended, and full of viscid fluid, † 2 days later Autopsy tumor size of a pea found at pap V, completely occluding it Dur few weeks
- SHEPHERD " (also DUVAL " M, 44 Progressive jaundice, pruritus Gbl distended with thick, dark bile, com d three times normal size Cholecystostomy, † 5 weeks later from exhaustion In lower portion of com d a soft, brownish-black, fungoid mass, 2.5 cm long, completely occluding the lumen of the com d, entirely confined to com d and ampulla Micr composed almost entirely of pigmented cells, but structure resembles in many ways that of epithelioma Origin, apparently tunica propria of com d and ampulla Diagnosis "melanoma" Dur 3½ mos
- SOUQUES and AYNAUD " Case 1 F, 43 Jaundice, cough, expectoration Gbl dilated, com d size of index-finger A hard tumor, size of a pea, at pap V Com d passes through the tumor, but is not completely obstructed Micr cylindrical-cell carcinoma, arising from ampullary portion of com d Metastatic nodules in liver and lungs Dur several weeks Case 2 M, 72 Progressive jaundice, pruritus, abdominal colics, diarrhoea All ducts dilated At pap V a round tumor, somewhat smaller than in Case 1, pushing up duodenal mucosa Micr cylindrical-cell carcinoma, infiltrating walls of com d and completely obstructing its lumen Dur 3 mos
- STABEL " M, 50 Intense jaundice, chills, pain in liver region Gbl greatly distended Cholecystostomy, † from abscess in kidneys and prostate Primary carcinoma found in com d at its opening into duod
- STOKES " M, 68 Deep jaundice, fever, chills, pruritus, constipation Distinct remissions in all these symptoms from time to time

beat was noted to the right of the sternum at level of the third rib. This disappeared in three days. There apparently was no increase of cardiac dullness or other signs of cardiac effusion. Temperature at this time was 100°, pulse 100, respiration 28. Drain was removed on August 17. Patient sat up in bed at this time. On August 21 dullness in the left chest posteriorly, with distant breath sounds, was noted over this area. Temperature 102.3°, pulse 124, respiration 28. On August 26 chest was aspirated and about eight ounces of a dark reddish, clear fluid evacuated. Upon culture this was found to be sterile. On September 14 chest was again aspirated, but only a small quantity of the same sort of fluid obtained. From this time on, patient rapidly improved. Signs of fluid in left chest diminished and when patient left the hospital on October 19 there was but slight dullness over left chest posteriorly, probably due to a thickening of the pleura. The heart at this time seemed to be slightly pulled to the left, apex beat being in sixth interspace one inch to the left of the nipple line. There were no murmurs present, sounds regular but a trifle rapid. Dr. Mitchell added that so much has been written of late as to the treatment of heart wounds that it does not seem necessary at this time to go very deeply into this subject.

König<sup>1</sup> in his article on "Technic for Access to Suture of the Heart," gives a full discussion on this subject, and Poole,<sup>2</sup> gives a most exhaustive study of the technic, as well as the bibliography of recorded cases up to the year 1912. He has succeeded in tabulating 77 cases of heart suture, which added to those already tabulated in 1909 by Peck totals 236.

Ranzi<sup>3</sup> gives Rehn the credit of publishing the first successful case of heart suture in 1896, and has collected 223 operative cases with a mortality of 53.3 per cent. He adds to this number three cases of stab-wound and also three of gun-shot wound of the heart, who were operated upon in Von Eiselsberg's Clinic at Vienna, but only one of which recovered. He mentions in the successful case, that five hours intervened between the time of injury and operation, and states in naming the time of the operation that the anæmia was not very marked.

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<sup>2</sup> *ANNALS OF SURGERY*, April, 1912

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but passable for a fine probe, pan d completely obstructed Tumor size of a pea found completely surrounding the pan d at its lower end, with slight extension to wall of com d Micr carcinoma, arising from terminal portion of pan d Pancreas indurated, atrophic; duct dilated throughout Dur 6 mos

LINDNER " Case 1 M, 50+ Intense jaundice, frequent colics Gbl enlarged, numerous stones Small primary carcinoma in duod portion of com d Dur few weeks Case 2 M, 60+ Symptoms and findings same as Case 1 Dur several months Case 3 M Intermittent jaundice, pruritus Cholecystenterostomy, 7 5th day (cholæmic hemorrhage from stomach) Small carcinoma found at pap V Case 4 F, 56 Intermittent jaundice, colics Gbl moderately enlarged, com d much dilated, both filled with many large stones Cholecystostomy, at 2d op fistula closed, 7 2 days later Small primary carcinoma found in duod portion of com d

MARTIN " M, 60 Intense jaundice, severe abdominal pains; vomiting Gbl 19 cm long, com d size of index-finger; both filled with clear fluid Second portion of duod transformed into a tumor size of the fist, most prominent at pap V Head of pancreas also cancerous Origin probably pap V, with secondary involvement of pancreas Dur 5 weeks (Owing to the large size of this tumor, and lack of microscopic examination, its nature must be considered undetermined)

MAX " M, 67 Intense jaundice, abdominal pain last two days before death, pruritus Gbl perforated and collapsed, com d enormously dilated Many small, blackish stones in gbl, cystic and com ducts At mouth of com d a hard, ring-like tumor, size of a cherry, partly projecting into the duodenum Micr cylindrical carcinoma, arising from duod end of com d Metastatic nodules in liver Dur 1 yr

MCNEAL (GIDDINGS) " Case 2 M Universal jaundice, with slight remissions, vomiting; purging Gbl enormously distended, com d size of middle finger, stones in both Mass in portion of duod which is entered by com d, completely occluding this, the mass shows "encephaloid degeneration," and is ulcerated toward the intestinal lumen Trunk and primitive bifurcations of the portal vein completely occluded by encephaloid matter Head of pancreas enlarged and hard

MORAY " F, 78 Progressive jaundice Gbl and com d dilated, and filled with thick, black bile Hard nodule size of a bean in duod wall at mouth of com d Micr . cylindrical-cell carcinoma, arising from duod mucosa Dur 3 weeks

MORIAN " Case 1 F, 63 Progressive jaundice Gbl markedly enlarged, many small stones Com d. dilated, and filled with a yellowish-white tumor mass, which extends up into hepatic duct Micr carcinoma White nodules in liver (metastases?) Dur 4 mos Case 2 M 69 Jaundice; abdominal pains, ascites Cholecystostomy Six weeks later cholecystenterostomy, † 2d day Autopsy com d dilated, wall thickened for a distance of 1 cm, beginning just above pap V Dur 5 mos Case 3 F, 54 Jaundice, intermittent in intensity, pruritus Gbl. shrunken, one stone Com d. size of thumb Cholecystenterostomy

## TENDON FIXATION.

A PRELIMINARY REPORT OF A SIMPLE OPERATION FOR THE PREVENTION  
OF DEFORMITY IN PARALYTIC TALIPES

BY W. E. GALLIE, M.B.,

OF TORONTO, CANADA.

Associate Surgeon, Hospital for Sick Children, and Junior Surgeon, Toronto General  
Hospital

DISSATISFACTION with the results obtained from arthrodesis, tendon transplantation and silk ligament installation led to the trial of the method which is here reported

CASE I—A W, a boy eight years of age, had had anterior poliomyelitis six years ago, resulting in permanent complete paralysis of the right peronei muscles and partial paralysis of the dorsiflexors of the foot. Equino-varus resulted which was corrected in October, 1909, by forcible manipulation and tenotomy of the tendo Achillis. A stop joint ankle brace with an outside T strap was applied after the removal of the plaster of Paris and a splint was worn at night. Two years later the patient returned to the hospital with a recurrence of the varus deformity. The dorsiflexors had regained fairly good power and there was no further tendency to toe drop. Arthrodesis was then performed at the astragalo-navicular and calcaneo-cuboid joints, the varus being completely corrected. The operation resulted in solid union. Six months ago the patient returned to the hospital with a marked recurrence of the varus, the deformity occurring at the ankle joint. The ankylosis at the midtarsal joint was still quite firm, and as far as this joint was concerned, the contour of the foot was correct. The whole of the deformity was due to the pulling of the astragalus out of its socket. To overcome this deformity and to prevent its recurrence the following operation was performed.

A vertical incision, three inches in length, was made on the outer side of the leg, over the peronei tendons, extending downward to below the styloid process of the fibula. The tendon of the peroneus longus was freed by division of the upper part of

Gbl and comd greatly distended, walls of former thickened Orifice of comd in duod surrounded by an irregular fungus, resembling an old cicatrix Dur 1½ yrs

THOMAS <sup>63</sup> F, 53 Persistent jaundice All ducts much dilated, and filled with puriform fluid At pap V a tumor, ulcerated toward duod Micr cylindrical-cell carcinoma, arising from the ampulla, or (according to Letulle) from the intestinal mucosa covering this Dur 4 mos

WEIR <sup>65</sup> M, 35 Very marked jaundice, pain in liver region Gbl and all ducts dilated Cyst in pancreas drained, 10 days later cholecystenterostomy, † 2 hours later A soft tumor, 3 cm in length, of cauliflower appearance, found rising slightly above intestinal mucosa, in centre of this, the opening of the comd and pand Micr carcinoma Dur 7 weeks (Lannois and Courmont consider this a case of carcinoma of the pancreas)

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# TENDON FIXATION.

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This operation has been performed on three other patients. One was a case of varus, similar to the case above, one was a case of equino-varus, with complete paralysis of the dorsiflexors as well as of the peronei, and the last was a case of equino-valgus, there being complete paralysis of the dorsiflexors and adductors of the foot.

Case No. 2 was identical with Case No. 1, except that in the former no previous operations had been performed.

In Case No. 3, in addition to the fixation of the peronei tendons, a similar fixation was performed on the tendon of the tibialis anticus, the tendon being buried under the periosteum of the tibia, on its anterior border. It is now four months since the operation, and there is no tendency to recurrence of the varus and plantar flexion is not possible past a right angle, owing to the fixation of the tendon of the tibialis anticus.

In Case No. 4 it was necessary to do a tenotomy of the peronei tendons as well as of the tendo Achillis. A fixation was then performed on the tibialis anticus as in Case No. 3, and in addition the tibialis posticus was dealt with in a similar manner, being buried under the periosteum of its own groove. The patient is now walking about with the assistance of a Whitman flat foot brace and as yet there is no tendency to recurrence of either valgus or equinus.

It is not to be expected that as much can be achieved by an operation such as that performed in Case No. 4, where the fixed tendon has to support the body weight, as from those operations in which the fixed tendon has simply to support the weight of the foot or to resist the tendency to contracture of antagonistic muscles.

In none of the cases has a longer time than five months elapsed since the operation, so that in no sense can this report be considered a report of final results. But if the fixation holds and the tendon does not stretch, this operation has the advantage of preventing the deformity in a manner which most closely resembles normal conditions. The results so far obtained are sufficiently encouraging to warrant a further investigation of this method of treatment.

the external annular ligament, and displaced sufficiently far forward so that traction upon it produced dorsiflexion. With the tendon in its normal position, traction upon it would produce plantar flexion. A vertical incision two and a half inches long was then made through the periosteum of the anterior surface of the fibula down to the lower extremity of the bone. The periosteum was elevated for a quarter of an inch on either side of this incision and with a gouge a piece of bone, two and a half inches long and of the thickness of the peroneal tendon, was removed from the fibula. With the assistance of a pair of Kocher's clamps the tendon was drawn taut, thus dorsiflexing and abducting the foot, and the tendon laid in the trough prepared for it. Here it was securely fastened by a No. 1, thirty day chromic catgut suture, which caught the two edges of the periosteum and the tendon itself, completely covering the tendon with the periosteum for a distance of two and a half inches.

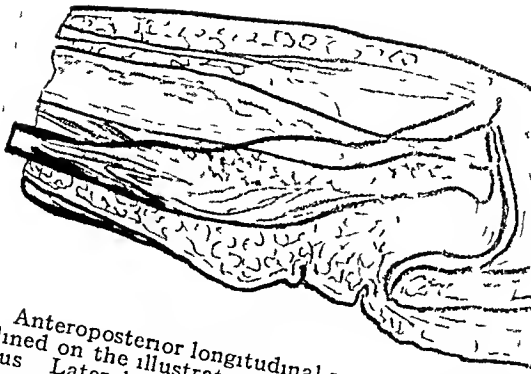
A similar vertical incision was made in the periosteum under the peroneus brevis, and this tendon treated as was the peroneus longus. The external annular ligament was now sutured with catgut and the skin closed with horse-hair. The foot was held in this correct position by a plaster of Paris bandage.

The reason for displacing the tendon of the peroneus longus forward was to prevent the production of a fixed equinus from the tightening of these tendons. By the new arrangement the action of the two peroneal tendons balanced each other.

A month after the operation the plaster was removed. Healing had occurred by primary union and the foot was in good position and held firmly by the fixed tendons, although the strength of the fixation was not severely tested. Plaster was reapplied.

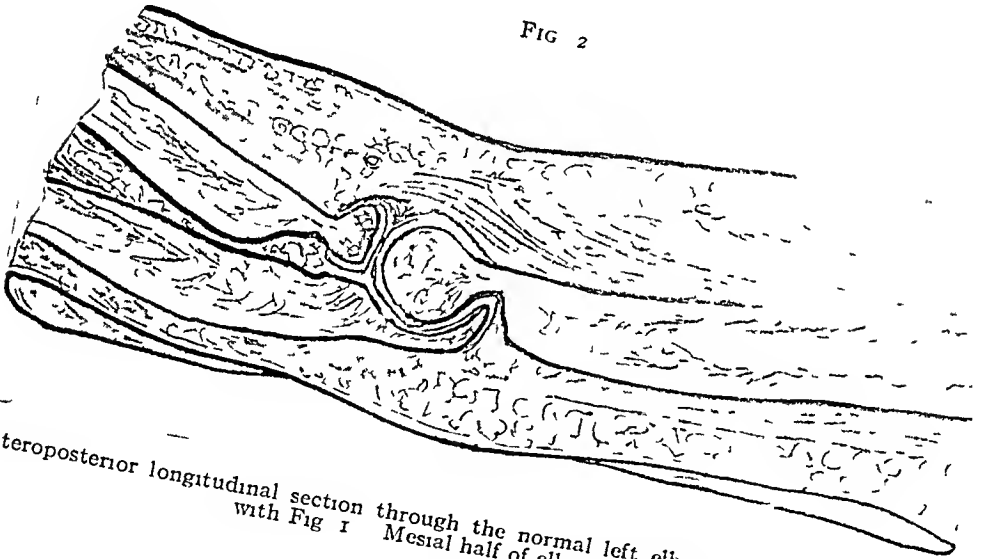
Nine weeks after the operation the plaster was again removed and the foot found to be held firmly in a correct position by the fixed tendons. The fixation was quite solid, as demonstrated by the fact that strong attempts to adduct the foot were unsuccessful. The range of voluntary and passive dorsiflexion was normal, while that of plantar flexion was limited about one-half by the fixed tendon.

For the past two months the patient has been walking without a brace and there has been no tendency to recurrence and so far the operation has been successful.



Anteroposterior longitudinal section through the lateral half of elbow region outlined on the illustration to show its general appearance

FIG 2



Anteroposterior longitudinal section through the normal left elbow-joint for comparison with Fig 1 Mesial half of elbow region



FIG. 3



Fig. 3. A blood vessel cut obliquely  
 in the center of the section.

by fibrous tissue. The age of the patient interferes with any inference drawn from the character of the marrow.

I am not disposed to regard this case as a controversion of the views suggested by Ely, in defence of which he has brought forward so much evidence.

I have described the case in view of the fact that it exhibited a healed tuberculous elbow in which a joint cavity was still present, and because opportunities of investigating such joints are comparatively rare.

Professor Elliot Smith kindly placed the subject at my disposal, and Professor Lorrain Smith gave me much useful criticism on the histology of tuberculous joints. To both of these gentlemen I would therefore acknowledge my indebtedness.

#### SUMMARY

The end result of partial excision of the elbow-joint for the cure of tuberculosis may be perfectly successful and yet a joint cavity may remain.

The cure of such a case does not necessarily depend on the obliteration of the joint cavity and its replacement by fibrous tissue.

# THE ARREST OF HEMORRHAGE FROM BONE BY PLUGGING WITH SOFT TISSUES

BY GEORGE TULLY VAUGHAN, M D,

OF WASHINGTON, D C

THIS method of arresting hemorrhage was first used by me some ten years ago, and I desire again to invite the attention of surgeons to its simplicity and efficiency. I have used it with satisfaction in a great many operations where bleeding from the bone was troublesome, as in fractures of the skull, sections of the skull for any purpose, as for tumor or Gasserian ganglion removal, amputations, resections, bone transplantation, and in osteomyelitis to prepare the cavity for iodoform or bismuth paste.

The method consists in cutting a fragment of soft tissue, muscle or fascia, preferably muscle, from any convenient place in the field of operation and applying the fragment to the bleeding surface or edge of the exposed, broken, or cut bone by means of the fingers. If the tissue does not adhere at once it should be rubbed into the bleeding area by some suitable instrument, as a knife handle, dissector, or chisel, so that the vascular openings in the bone become plugged with little fragments of soft tissue. The advantages are obvious—the material is always present, it does not require special preparation, it does not act as a foreign body, and, according to my experience, it is always efficient.

# AN OPERATING TABLE FOR USE IN ANIMAL RESEARCH.

BY KATHARINE STEBBINS,

OF NEW YORK

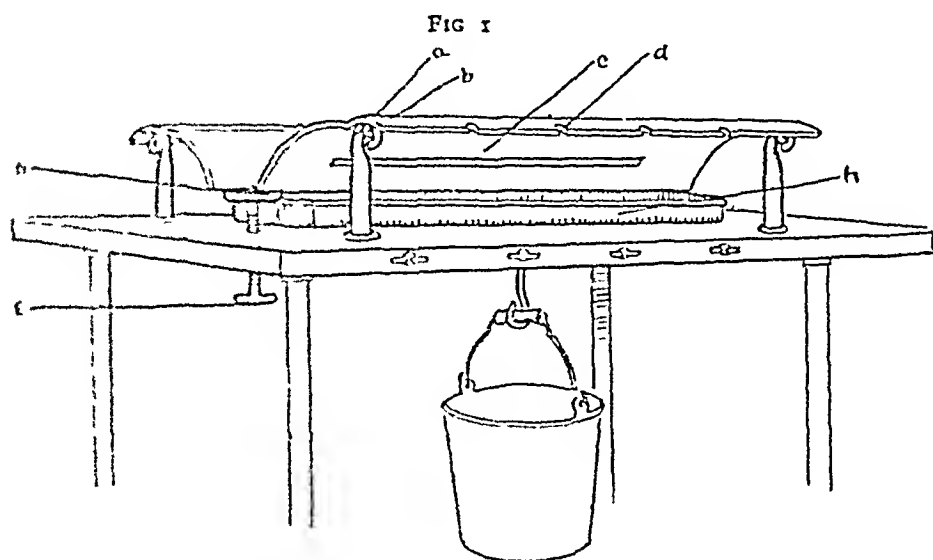
Nurse in charge of the Surgical Research Laboratory of the Department of Surgery, in the College of Physicians and Surgeons Columbia University

THE animal operating tables in use in the Surgical Research Laboratory of Columbia University are the result of a year's experience with the ordinary type of wooden rack and a constant consideration of its faults, with a view to producing a device of such construction and material as to meet every demand of convenience and asepsis

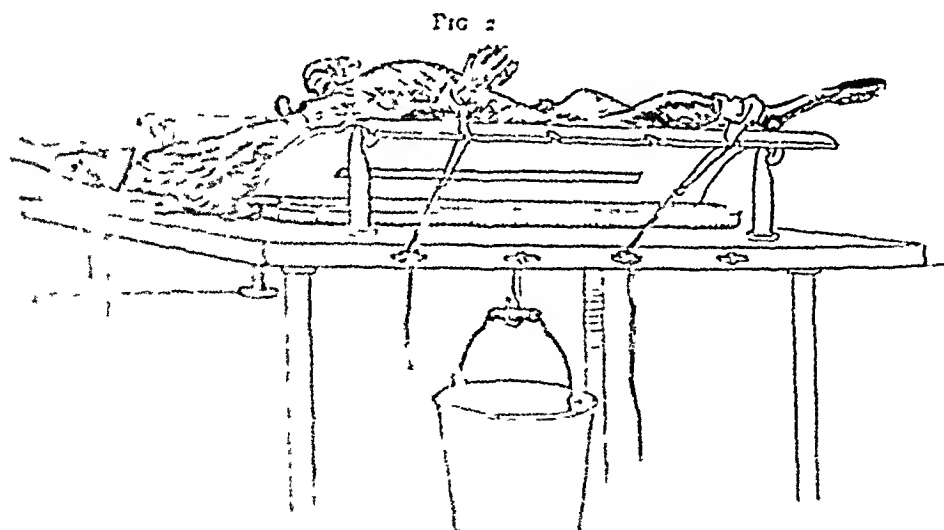
The most obvious faults in the usual rack are, first, its inflexibility, making it difficult to adjust animals of various sizes; second, the absorbability of the wood if unpainted, and the impossibility of covering with a paint which will not stick to the animals' fur when wet with chemicals or blood, third, the difficulty of convenient drainage, and, most important of all, fourth, the impossibility of being assured that the experiments are carried on under conditions of proper asepsis. In the use of dogs of the available type, where the skin and hair are particularly difficult to clean, the latter objection becomes a serious one. In order to overcome these various faults, and at the same time to produce an operating table sufficiently inexpensive to be practical for the research laboratory, the outfit shown in the accompanying sketch has been devised by the writer

Four posts of enamelled iron are screwed to the surface of a table. At the top of the post is a hook (*a*), so curved as to interlock and form a hinge with a lug (*b*) on the under side of the adjustable leaf (*c*). These leaves are also of enamelled iron, with a groove along the upper edge fitting over the top of the posts, to make the hinge turn smoothly and give support at every angle, and are shaped to form the sides of a trough which receives the animal's body. On the upper edge of each leaf is a series of notches (*d*), through which pass the ropes for fastening the limbs, and which are made fast to small cords on the edge of the table. The trough is made of the same material

depth, to fit any animal from a cat or rabbit to a large dog by adjusting a screw (c) under the table. This screw raises or



lowers a strong cross-bar (f) by means of a centre, and the lower edges of the leaves rest on this cross-bar. Two longitudinal slit in the leaves, and the aperture between the lower edges,



jured side suffered more than its fellow, and the circulation was not as good, this gave the patient but slight inconvenience

#### COMPLETE SEVERANCE OF SUPERFICIAL LAYER OF FLEXOR TENDONS OF WRIST TENORRHAPHY

DR SCHLEY presented a boy, ten years old, who while turning the knob of a glass panel door loosened a sheet of broken glass, which in falling passed across the anterior aspect of the wrist, half an inch above the annular ligament. The radial artery and all the superficial tendons were completely divided, and the median nerve was badly nicked (Fig 2). The artery was ligated, and the skin wound was sutured by a physician, who gave a very bad prognosis as regarded function. When Dr Schley saw the boy, a week after the accident, the wound had become badly infected. It was reopened, and about four weeks were allowed to elapse before it was thought safe to attempt tendon repair. An incision four inches long was made along the anterior aspect of the forearm, crossing the original cut, and as each divided tendon was found it was freshened and sutured to its distal segment with a single mattress suture of fine silk. The retraction of the tendons had been so considerable that the sheaths had to be incised. No attempt was made to do anything to the median nerve, as it had been only partly divided. The arm and wrist were then put up in half flexion. For three months following injury there was noticeable impairment of function of the thumb muscles—the opponens, abductor, and flexor brevis pollicis. Result perfect, motion as free and strong as before.

#### OSTEOPLASTIC CRANIECTOMY ILLUSTRATING THE USE OF THE DE MARTEL APPARATUS

DR JOHN A HARTWELL, presented a man, 33 years old, who was admitted to the hospital on November 15, 1912, complaining chiefly of headaches and twitching of the right side. The history he gave was that seven weeks prior to his admission he was struck on the upper posterior portion of the left frontal bone with a heavy iron bar. He immediately felt numb and became unconscious, and when he awoke in the hospital six hours later he complained of feeling drowsy and had a sharp, lancinating pain in the left eye. He went to sleep again, and when he awoke, seven hours later, he had a very severe unilateral headache on the left side. During the first two days after his injury he suffered from nausea and vomiting, the latter being at times projectile in character. The headache gradually became less

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY.

*Stated Meeting, held December 11, 1912.*

The President DR CHARLES L GIBSON, in the Chair

### COMPLETE SEVERANCE OF ALL STRUCTURES ON THE FLEXOR SURFACE OF THE WRIST TENORRHAPHY AND REPAIR

DR W S SCHLEY presented a man, 28 years old, who fell from a step-ladder through a glass door, and in trying to save himself thrust his arms forward. The right wrist came in contact with a sharp edge of glass and every structure upon the anterior aspect was divided to the bones (Fig. 1). A nearby physician placed a tourniquet on the arm, and the man was sent to the hospital. After securing the ulnar and radial vessels, the wound was thoroughly irrigated with saline solution, and immediate suture of the divided tendons begun. To locate the retracted proximal ends and secure sufficient working space, a five-inch incision was made up the middle of the forearm, crossing the wound at its centre. Much difficulty was experienced in securing each tendon to its distal end, and the procedure was like trying to repair broken wires of a telephone switch-board. The median, radial and ulnar nerves were completely divided. The tendon sheaths were incised to secure the proximal ends, and the tendons were sutured with a mattress suture of fine silk. The divided ends of the median nerve were stitched with fine catgut. The ulnar and radial nerves were not sutured.

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# THE END RESULT OF EXCISION OF THE ELBOW FOR TUBERCULOSIS

BY T WINGATE TODD, MB, FRCS,

OF MANCHESTER, ENG.,

Lecturer in Anatomy in the University of Manchester

My excuse, as an anatomist, for intruding on the domain of surgery in the clinical investigation of tuberculous joints, is the discrepancy in accounts by various writers of what is ultimately the state of the joint in the cure after operation on tubercular disease of the elbow. One rarely has the opportunity of thoroughly investigating the condition of a cured tuberculous elbow which has undergone treatment by excision. Such an opportunity having occurred in the department of clinical anatomy in the University of Manchester, I venture to give an account of the pathology of the case, in the hope that it may be of service to clinical investigators of tubercular disease of this joint.

In his recent book on joint tuberculosis Ely brings forward the suggestion that tubercular disease of a joint is invariably a disease of the synovia and red marrow<sup>1</sup>. On page 95 he states the following regarding the radical treatment of tubercular joints:

If the cure can be brought about by ankylosis or by dislocation, it is not anything in ankylosis itself that brings it about but it is essentially the destruction of the joint.

The synovia and red marrow owe their presence here to function in the joint, and if function be removed they disappear. If they disappear, the disease cannot exist in that locality. Without them there can be no such thing as joint tuberculosis.

Of the elbow my specimens do not enable me to speak positively. Probably the matter stands as in the hip, that is, cure by fibrous union or by bony ankylosis.

Again, on page 175, this author makes the following statement in his description of tuberculosis of the elbow-joint:

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<sup>1</sup> Ely Joint Tuberculosis, 1911.

of both condyles of the left elbow When he entered St Luke's Hospital, 24 hours after the accident, the problem was to reduce and hold in good position the fragments of a bone which had been fractured at both extremities The usual methods of holding the fragments were tried but gave disappointing results Having observed the excellent results obtained by Dr Royal Whitman in the treatment of epiphyseal displacement and fracture of the upper extremity of the humerus by assuring definite adjustment and fixation of the fragments, it was decided to treat the fracture of the upper third of the humerus in this manner, and the transcondylloid fracture by Jones's method of supination and acute flexion

With the patient under ether, the fragments were separated, the upper fragment was grasped, and the arm slowly abducted to the extreme limit, the acromion serving as a fulcrum The abducted arm was moved slightly forward, the forearm was supinated and acutely flexed This position was maintained by a shoulder spica which extended from the wrist and inclosed the elbow, the arm, the shoulder and the thorax Contrary to expectations, this position proved to be very comfortable, and at the end of four hours the swelling of the arm had disappeared The bandage was removed on the 37th day, when both fractures were solidly healed and both joints allowed considerable motion It was now a month since the bandage had been removed, and the boy had perfect functional use of both joints A number of X-ray plates were exhibited by Dr Lyle to show the anatomical results

#### OBSTRUCTIVE JAUNDICE FROM AN IMPACTED STONE IN THE COMMON DUCT PERTHES'S INCISION, CHOLE- CYSTECTOMY, CHOLEDOCHOTOMY

DR H. M. LYLE presented a woman, 57 years old, who entered St Luke's Hospital on September 18, 1912, giving a history of gall-stones which extended over a period of 20 years A year ago she had a severe attack of gall-stone colic, with a typical blockage of the common duct Her jaundice still persisted and was now intense She was weak and emaciated, and had lost over 60 pounds A moderate grade of mitral insufficiency was present The liver extended for two fingers' breadth below the free border of the ribs The gall-bladder could not be palpated, and there was a marked diastasis of the recti

The patient was regarded as a very bad surgical risk; it was reasonably certain that numerous adhesions would be encountered, and the conditions called for an incision that would give ample

joint the operation was found to have partaken of the nature of partial, rather than of complete, excision. The olecranon had been entirely removed, together with the articular surface of the humerus. The coronoid process and the head of the radius had been left *in situ*. A joint cavity was found and contained a small amount of glairy synovial fluid. The portions of bone left had undergone osteoporosis and showed yellow marrow only. No osteophytic growths were present. The lower end of the humerus overlapped the ulna by 3.5 cm.

Fig. 1 shows a longitudinal section through the joint, while Fig. 2 is an illustration of a similar section made through the healthy left elbow-joint for comparison with Fig. 1. Dense fibrocartilaginous tissue covered the wasted coronoid process and head of radius. The capsular ligaments had been little interfered with except behind. Adhesions were numerous in the superior radio-ulnar joint. Synovial membrane appeared to line the joint cavity. Histological sections were therefore made to ascertain whether tubercle were still present and whether synovial membrane really did exist. The following is the result of the microscopic examination.

Sections of the joint lining adjacent to the sites where bone had been excised show a lining of synovial membrane and the formation of synovial villi. No giant-cells are present, the nearest approach to them being such an appearance as that figured at *a*, Fig. 3.

This, however, on closer inspection proves to be part of the wall of an obliquely cut blood-vessel. No lymphocytes are present in the tissues. Amyloid degeneration is nowhere to be found, though it was specially sought for. The walls of the blood-vessels are thickened and from the reaction of this tissue to eosin and acid fuchsin, it appears to be hyaline in character.

Thus the joint shows regeneration of synovial membrane and no evidence of active tubercular disease. Indeed the presence of hyaline degeneration is the only appearance which could be connected with the presence of old cured tuberculosis.

The result of the investigation of this case is not so satisfactory as could have been wished. This is the natural result of an incomplete operation. The case shows, however, that the cure of a tuberculous elbow by excision need not necessarily involve total destruction of the joint and its replacement

portion of the technic, and in the same number of the *Zentralblatt* (pp 1252-1256) described his incision for operations on the gall-bladder and ducts

#### GASTRECTOMY, CHOLECYSTECTOMY, CHOLEDOCHOSTOMY

DR JOHN F ERDMANN presented a woman, 68 years of age, upon whom he had operated four years ago for a hydronephrosis of the right kidney, which contained a large number of small calculi, sufficient to fill a six-ounce bottle. At that time he did a nephrectomy, also removing an ovarian cyst and the appendix.

The patient remained perfectly well until a year ago, when she returned complaining of severe gall-bladder colic, together with pain after eating, loss of flesh, etc.—symptoms which led to the suspicion of a neoplasm of the stomach.

On June 22, 1912, Dr Erdmann exposed the gall-bladder through a median incision, doing a cholecystectomy for atrophied gall-bladder which contained 112 stones. He also did a choledochostomy, removing 68 stones from the common and hepatic ducts.

There was present also an extensive but freely movable cancer of the pylorus, and a pylorotomy and partial gastrectomy was done, four-fifths of the stomach being removed. The patient recovered rapidly, and had gained 13 pounds in a few weeks.

#### CARCINOMA OF THE STOMACH GASTRECTOMY

DR ERDMANN presented a man, 46 years old, upon whom he operated on October 22, 1912, for an extensive carcinoma of the stomach, necessitating the removal of four-fifths of the stomach, with the pylorus. Recovery was perfectly smooth, and the patient had been free from symptoms since the operation.

This patient had presented mixed symptoms suggestive of both ulcer and carcinoma. The pathological report showed that cancer was engrafted upon an ulcer.

In reply to a question by Dr Gibson, Dr Erdmann said that in 21 gastrectomies recently performed he had done the posterior gastro-enterostomy 19 times, and the anterior but twice.

#### PERFORATION OF THE UTERUS DURING CURETTAGE, WITH PROLAPSE OF THE GUT, NECESSITATING THE REMOVAL OF TWO FEET OF INTESTINE

DR. JOHN F ERDMANN presented a young woman whom he was called to see about three hours after she had been curetted in a physician's office for a suspected miscarriage. The duration of

severe, and the patient left the hospital 16 days after the receipt of his injury. On the afternoon of that day he had two attacks of dizziness and "giving way" of the right side, without premonitory symptoms. He did not lose consciousness entirely, but sank slowly to the ground and could not rise for four or five minutes. During the following six weeks he had about 15 similar attacks, these usually occurred in the afternoon, and were accompanied by aphasia. He usually fell to the right side, and after such a seizure complained of severe unilateral headache which persisted for the rest of the day and was somewhat alleviated by a night's rest. The patient also stated that about a week after the injury he became nervous and developed jerky twitching movements of the entire right side of the body. He described these as having their onset in the tips of the right fingers, and extending up to the arm and face and down the leg.

The headaches gradually became more severe and constant, and when the man returned to the hospital he was examined by Dr. M. Allen Starr, who expressed the opinion that the patient had an extensive cortical hemorrhage, with laceration of the meninges, and advised an exploratory trephine operation. In November, 1912, Dr. Hartwell, under gas and ether intratracheal anæsthesia, made an incision in the left temporal region, and then did an osteoplastic craniectomy, using the De Martel apparatus. There was very little bleeding from the bone, but considerable oozing from the surface of the dura, which was more adherent to the skull than usual. The dura was tense, but pulsating, it was incised and reflected, showing an apparently normal brain surface. The dura was sutured and wound closed. The patient made an uneventful recovery, and when he left the hospital, November 29, there had been no recurrence of his symptoms.

Dr. Hartwell also briefly reported a second case of osteoplastic craniectomy in which he used the De Martel apparatus. He referred to the ease and rapidity with which the skull could be opened by means of this instrument, and its comparative safety in guarding the dura from injury.

FRACTURE OF THE UPPER THIRD OF THE LEFT HUMERUS,  
WITH A TRANSCONDYLOID FRACTURE OF THE  
ELBOW. TREATMENT BY THE COMBINED  
WHITMAN-JONES POSITIONS

DR. H. H. M. LYLE showed a boy, five years old, who fell 20 feet, sustaining a fracture of the upper third of the humerus and

## BOOK REVIEWS.

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SURGERY OF DEFORMITIES OF THE FACE, INCLUDING CLEFT PALATE By JOHN B ROBERTS, A M, M D, Professor of Surgery in the Philadelphia Polyclinic Large octavo, 273 pages; 273 illustrations

IN this book the author has summed up the experience of a long professional life during which plastic work about the face has especially engaged his attention. Contributions of a minor character covering operations in this field have from time to time issued from his pen. One characteristic of Dr. Roberts' work, which has always impressed his colleagues, is his absolute honesty, so that when any one takes up a volume from his pen they feel sure that in it there is a plain and unvarnished tale in which both the successes and failures, merits and demerits of the various procedures described will be set forth. The author's style is plain and simple and his statements are so expressed as to convey their meaning to the reader without any question. The illustrations are abundant and have the rare merit of aiding the reader to understand the text. The author devotes two initial chapters to a historical account of the development of plastic surgery in general, then, after a survey of the anatomy of the face and the characteristics of the surgery of that region, he proceeds to a study of the principles of the special plastic procedures involved in the surgery of the region. Naturally the greatest interest in the surgery of this region attaches to the correction of harelip and cleft palate. The author devotes two chapters to this subject. His treatment of the subject is full and in general most satisfactory, but we could wish that he had emphasized with more detail the importance of preserving the intermaxillary bone. In the work of inexperienced surgeons,—and it is for them that this book is written,—this troublesome protrusion is too often sacrificed, because its importance for the future development of the jaw and for the prevention of most lamentable disfigurement, notwithstanding the repair of the fissured lip, is not sufficiently realized. A set of illustrations showing the later conditions produced by the loss of the intermaxillar,

room for rapid and thorough work. It was thereupon decided to employ Perthes's incision, which was hockey-shaped, the vertical arm starting in the median line just below the ensiform cartilage and descending to within two fingers' breadth of the navel, it then turned horizontally outward until the fibres of the external oblique were exposed. The anterior sheath of the right rectus was opened in the median line and the index-finger of the left hand inserted between the posterior surface of the right rectus and its posterior sheath. At the level of the transverse incision a double row of mattress sutures was inserted to bind the rectus muscle to the anterior sheath, the finger keeping the needle from penetrating the posterior sheath. The muscle was then cut transversely between the two rows of mattress sutures. The rectus muscle, bound to its anterior sheath, was then reflexed upward over the free margin of the ribs until the two intercostal nerves were seen entering the posterior surface of the rectus. An oblique incision, one finger's breadth below these nerves and parallel to the free border of the ribs, was made through the posterior sheath into the peritoneal cavity.

The advantages of this incision, Dr Lyle said, were (1) It gave an excellent exposure, (2) no nerves were cut, (3) the suture of the peritoneum and the posterior sheath in oblique incision was simple and this line of suture covered by the rectus, (4) it yielded a strong abdominal wall, in the rectus he substituted an artificial transverse fibrous band if he did not go through a natural one, (5) it afforded opportunity for work on the appendix, etc.

Dr Lyle said he felt that in this particular instance without such an excellent exposure he would have lost the case. The patient's general condition was critical, and the dense adhesions surrounding the common duct were difficult to handle. The gall-bladder was excised, a large stone was removed from the common duct and four from the hepatic duct. The common duct was drained. The patient made an uninterrupted recovery and now possessed a strong abdominal wall.

The transverse division of the rectus, Dr Lyle said, was described by Sprengel before the German Surgical Congress in 1910. In the *Zentralblatt für Chirurgie*, No 24, June 15, 1912, page 809, he described a method of making the suturing of the transverse wound easier. Perthes, in the *Zentralblatt für Chirurgie*, No 37, pp 1249-1252, still further improved this

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segment would not be difficult to get and would be most instructive. We do not wish to be considered as saying that the text anywhere suggests the sacrifice in any case of the protruding intermaxillary segment, but merely to express our opinion that it is an element in the subject which cannot be too fully dwelt upon. The importance of repairing by stages the more extensive defects of the palate and lip in the new born, also, cannot too strongly be set forth. This is well stated in the recapitulation which the author gives at the close of his discussion of the various operative stages required for the complete procedure which, as he says, may occupy a year or two during which many periods of inactivity are furnished in order to insure safety to the child and permit the surgeon to see the effect of the various stages of his operative work.

Deformities of the nose with rhinoplasty receive full attention, and here we recognize the result of the special interest with which the author has followed the surgery of this region for so many years.

The book as a whole is of great interest, and we are indebted to the author for giving to his colleagues this valuable summary of the work of a long professional life.

LEWIS S. PILCHER

DEFORMITIES INCLUDING DISEASES OF THE BONES AND JOINTS  
A Text-book of Orthopædic Surgery, by A. H. TUBBY, M.S.  
(Lond.), F.R.C.S. (Eng.) Second Edition. Macmillan and  
Co., London and New York.

The first edition of Tubby's book appeared fourteen years ago. It represented the English point of view, that orthopædics was concerned with the treatment of actual deformity only. That this convention no longer holds is evidenced by the fact that nearly a quarter of the book is devoted to the affections that lead to deformity, notably diseases of the bones and joints, in which rational and timely treatment may prevent the otherwise inevitable distortions.

The work is divided into ten sections. Five are included in the first volume under the titles of congenital and static deformities and diseases of muscles, tendons and fasciæ. In the second volume are diseases of the bones and joints and paralytic deformities.

The author states that he has discarded the regional arrange-

ment in favor of the more scientific classification on an etiological and pathological basis. As deformities have such diverse causes, no arrangement can be perfectly satisfactory, and from the practical diagnostic and therapeutic stand-point, it may be questioned if the present classification, which requires so much repetition, has any advantage. For example, static deformities are considered in Volume I, and rickets, one of the most common causes of static deformities, in Volume II. The treatment of acquired talipes, usually caused by paralysis, is discussed in Volume I, while paralytic affections, including operative treatment by muscle transplantation, of which the chief value is in the treatment of distortions of the feet, are in Volume II.

As contrasted with the first edition, the contents of the two volumes are almost encyclopædic in range, and together with the illustrations it has been drawn from all sources, this country furnishing by far the largest proportion. It has been the author's intention to prepare an account of orthopædic surgery as it stands to-day, and he has presented the representative material so impartially that his own views and practice are not always well defined. It is evident, however, that he does not favor plaster supports. The Calot modification of the plaster jacket, generally recognized as a more efficient appliance than the original form, particularly in the treatment of disease of the upper and middle region of the spine, is not mentioned.

The various forms of plaster spicas used in the treatment of hip disease are not described. The author favors the Thomas brace, which is rarely applied in this country, and he describes at some length certain of the traction braces at one time a routine in treatment, but now in great degree displaced by apparatus that assures better fixation of the joint.

The author condemns the Mikulicz operation for torticollis and prefers in certain instances the gradual rectification of deformity after tenotomy to immediate overcorrection.

Some of the operations described for the correction of deformity might be omitted with advantage, for example, that of Ogston for knock-knee, by separation and displacement of the internal condyle of the femur, which, it may be assumed, has long since been discarded. On the other hand, there is no note of the operative treatment of Pott's disease for the purpose of inducing ankylosis at the seat of disease, which is at present

attracting much interest. It is true that the first paper on the subject is not yet two years old, but the article by Lange on buried metallic supports in which the question of bone transplantation is discussed and which is undoubtedly entitled to priority, in suggestion at least, is of much earlier date.

The Abbott treatment for lateral curvature of the spine which bids fair to displace all other methods of treating fixed deformity, first described in June, 1911, has also escaped the author's notice. That two methods of treatment should have not only been suggested but sufficiently tested as to assure for themselves permanent places in practice, since the completion of this book, is gratifying evidence of the activity in this branch of surgery in this country.

The figures are numerous and well chosen to illustrate the diseases and deformities, and the methods employed in treatment. The bibliography is accurate and complete.

The size and cost of the work and its method of construction may limit its availability as a text-book, other than for reference, but it is heartily recommended to those who may have especial interest in or some knowledge of the subject. The author states that if he had appreciated the magnitude and difficulty of the task, it is possible that his courage would have failed. One may congratulate him therefore upon the very satisfactory result of his labors.

ROYAL WHITMAN

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# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS

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### CONGENITAL INTERNAL HYDROCEPHALUS.<sup>1</sup>

ITS TREATMENT BY DRAINAGE OF THE CISTERNA MAGNA INTO THE CRANIAL SINUSES

From the Department of Surgery, Cornell University Medical College, New York City

BY IRVING S HAYNES, M D,

OF NEW YORK,

Professor of Applied Anatomy and Clinical Surgery, Cornell University Medical College,  
Visiting Surgeon to the Harlem and Red Cross Hospitals

### PART I

#### A INTRODUCTION

IN a paper upon the "Surgical Treatment of Meningitis" <sup>1</sup> read by invitation at the annual meeting of the American Laryngological, Rhinological, and Otological Society, at Philadelphia, May 14, 1912, it was suggested that the operation of drainage of the cisterna magna, which had been advocated by the writer for the treatment of meningitis, might also be advantageously utilized in the treatment of hydrocephalus

In making that statement, that form of this disease resulting from an attack of basilar inflammation which had blocked up the outlets of the fourth ventricle, especially the foramen of Magendie, was chiefly considered

On June 4, 1912, at the invitation of Drs Pisek and Peterson, the writer operated at the Post-Graduate Hospital for congenital internal hydrocephalus by the method herein described, of drainage of the cisterna magna to the surface

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\* Read before the New York Surgical Society, January 8, 1913

the pregnancy was not over eleven weeks. Upon examination, he found the patient in a fair degree of shock, with considerable abdominal distention and tenderness. A large plug of cotton was found in the vagina, upon the removal of which a mass was seen protruding which resembled the umbilical cord of a full-term child. This could be drawn out of the vagina for a distance of about a foot, and proved to be intestine denuded of its mesentery.

The patient was hurried to a hospital, and Dr Erdmann did an abdominal section, an hour later. He found the abdomen filled with blood-clots and some intestinal contents. The cæcum was markedly infiltrated with blood, excepting its outer aspect, and the mesentery was torn loose from the ileum for a distance of over two feet from the ileocæcal junction. This loop of intestine had escaped through a perforation in the uterus which was large enough to admit the thumb. The uterus was soft and boggy and enlarged to about a two months' pregnancy.

A resection of the intestine was done within one inch of the ileocæcal valve, and this one inch inverted into the cæcum. The proximal excision was done an inch beyond the point of denudation of the mesentery, and an ileocæcal side-to-side anastomosis made. A subtotal hysterectomy was done, the posterior wall of the cervix was split, with free iodoform packing drainage. The patient was discharged, well, at the end of three weeks.

Dr Erdmann said he could recall four additional cases of perforation of the uterus during curettage that came to his service for surgical attention. In one he did a hysterectomy on account of a large laceration of the uterus. In this case there were numerous contusions of the intestines, but a resection was not necessary. In the second case a hysterectomy was done, with the removal of twelve inches of intestine and the repair of a large rent in the bladder. This patient died. In the third case the tear was in the cervicocorporeal junction, with no marked evidence of peritoneal involvement. Under simple drainage the patient recovered. In another case the conditions were so grave at the time that no operative procedure was entertained, and the patient died within two hours after he saw her.

#### MYOSITIS OSSIFICANS TRAUMATICA, THE DIFFICULTY OF DIAGNOSIS FROM SARCOMA

DR. WILLIAM B. COLEY read a paper with the above title, for which see page 305.

*in lesser degree*, infant living at date of this writing, December 27, 1912, in miserable general condition, apparently suffering from severe marasmus (See Addendum)

CASE I—H M, male, aged six months Admitted to the Red Cross Hospital, October 19, 1912 Referred to the writer by Dr G. R. Pisek

At birth child appeared normal Six weeks after birth head began to enlarge, and has continued ever since When nine weeks of age ventricular puncture was performed at the New York Post-Graduate Hospital, and this or lumbar puncture has been repeated five times since, from 2 to 2½ ounces of clear fluid being removed at each puncture, but without any permanent improvement

*Condition*—There is a marked degree of hydrocephalus, the child cannot move its head on the pillow There is the convergent downward squint The face is thin and weazened, the body emaciated The arms are flexed and the hands clinched The child whines continuously.

*Operation* (October 22, 1912)—Ether-vapor anæsthesia by Dr Lumbard Dr Boynton and the House Staff assisting

The proposed operation was to expose the occipital bone from the margin of the foramen magnum to above the occipital protuberance by a median incision with lateral reflection of the periosteum and the attached muscles To trephine over the midpoint between the foramen magnum and the occipital protuberance, and from this opening to remove the bone upward so as to expose the termination of the longitudinal sinus With a manometer to record the pressure in the cisterna magna and in the sinus To connect the cisterna magna with the occipital sinus if it showed large enough or with the torcular, by means of a rubber tube having an internal diameter of 1.5 mm, and to suture it in place, the tube, silk, and needles having been previously sterilized in vaseline The tube was to be let into the cistern and sinus through minute incisions that would be completely filled by the tube, which, for this purpose, had firm resisting walls To complete the operation by closure of the soft parts after packing the débris of bone in the gap in the skull

The tubes are of firm consistency, with an internal diameter of from 1.5 to 2 mm, and varying in length from ¾ to 1 inch

segment would not be difficult to get and would be most instructive. We do not wish to be considered as saying that the text anywhere suggests the sacrifice in any case of the protruding intermaxillary segment, but merely to express our opinion that it is an element in the subject which cannot be too fully dwelt upon. The importance of repairing by stages the more extensive defects of the palate and lip in the new born, also, cannot too strongly be set forth. This is well stated in the recapitulation which the author gives at the close of his discussion of the various operative stages required for the complete procedure which, as he says, may occupy a year or two during which many periods of inactivity are furnished in order to insure safety to the child and permit the surgeon to see the effect of the various stages of his operative work.

Deformities of the nose with rhinoplasty receive full attention, and here we recognize the result of the special interest with which the author has followed the surgery of this region for so many years.

The book as a whole is of great interest, and we are indebted to the author for giving to his colleagues this valuable summary of the work of a long professional life. LEWIS S. PILCHER

#### DEFORMITIES INCLUDING DISEASES OF THE BONES AND JOINTS

A Text-book of Orthopædic Surgery, by A. H. TUBBY, M.S. (Lond.), F.R.C.S. (Eng.). Second Edition. Macmillan and Co., London and New York.

The first edition of Tubby's book appeared fourteen years ago. It represented the English point of view, that orthopædics was concerned with the treatment of actual deformity only. That this convention no longer holds is evidenced by the fact that nearly a quarter of the book is devoted to the affections that lead to deformity, notably diseases of the bones and joints, in which rational and timely treatment may prevent the otherwise inevitable distortions.

The work is divided into ten sections. Five are included in the first volume under the titles of congenital and static deformities, and diseases of muscles, tendons, and fasciæ. In the second, are diseases of the bones and joints and paralytic deformities.

The author states that he has discarded the regional arrange-

a tiny vertical cut in the membranes. The knife is withdrawn, the needle pulled through with the suture and tube attached, and the latter is pushed into the incision, filling it up. The tube is then tied in place. It should be compressed lightly to stop the flow of fluid through it. The technic is carried out on the side of the sinus. A sufficiently tight fit should be planned between tube and incision, so that the former shall be compressed by the membrane. After a little while, by its own elasticity the tube will expand and fluid flow through it. If considerable cerebrospinal fluid should have been lost during the operation, the pressure should be restored by following Keen's suggestion under similar conditions and inject into the cisterna magna a sufficient quantity of saline solution to make up for the loss.

The operative attempt upon the patient only followed the first few steps. The bone was easily bared and the oozing checked by hot compresses. A trephine was applied as planned. It was  $\frac{3}{4}$  of an inch in diameter. Notwithstanding an appreciation of the thinness of the bone and its softness, and while using most careful manipulation, on removing the trephine there was a gush of clear fluid from the lower half of the trephine cut and it was obvious that the trephine had gone through bone, dura, and arachnoid and opened the cisterna magna. It was therefore necessary to tightly close up the incision at once, so that death might not ensue from too sudden loss of fluid, which was done.

*Course of the Case*—The child did not die. Its fontanelles began to retract slowly. At the end of three days there was a distinct cavity over them. The child's general condition began to improve, and it was discharged from the hospital November 2. This improvement continued for three weeks longer, when the original symptoms gradually returned. The betterment in the child's condition may be explained in that the occipital sinus was severed by the coarse trephine and into it flowed the excess of cerebrospinal fluid, until later its opening gradually closed by a healing process and the fluid again began to collect in the intracranial spaces.

It might be said that the loss of fluid at the operation was responsible for the change. However, the opening in the skull was tightly closed at once by the finger and held thus until all



The result was unfavorable—the infant died from too free escape of the cerebrospinal fluid. In October last, a second case of this type was referred to me by Dr Pisek. A review of the literature on surgical interference in these cases showed that in all the plans proposed there were no curative promises. The cases all terminated fatally sooner or later, and the exceptional recovery obtained at infrequent intervals might as well be credited to spontaneous cure as to the surgical interference. After considering the question of hydrocephalus in its various aspects, the conclusion was reached that the best place to drain off the hydrocephalic fluid was into the cranial sinuses and that this drainage should take place from the cisterna magna. The technic of its accomplishment is detailed in the case reports. The operation was successful in that drainage was established into the occipital sinus. This channel functionated for three weeks and then gradually closed.

Further, search of the literature disclosed that while this plan of draining the cerebrospinal fluid from the great cistern into the cranial sinuses seemed to be original with the writer, Gartner,<sup>2</sup> in 1895, had asked if it were not possible to establish a communication between the hydrocephalic cavity and the lymphatic or venous systems through a sinus or a vein of the head, and that Payr,<sup>3</sup> in 1908, announced a method of uniting the lateral ventricle with the superior longitudinal sinus by means of a piece of the long saphenous vein. This operation will be reviewed at length, also the one of Bier,<sup>3</sup> of drainage of the same ventricle by means of the temporal vein.

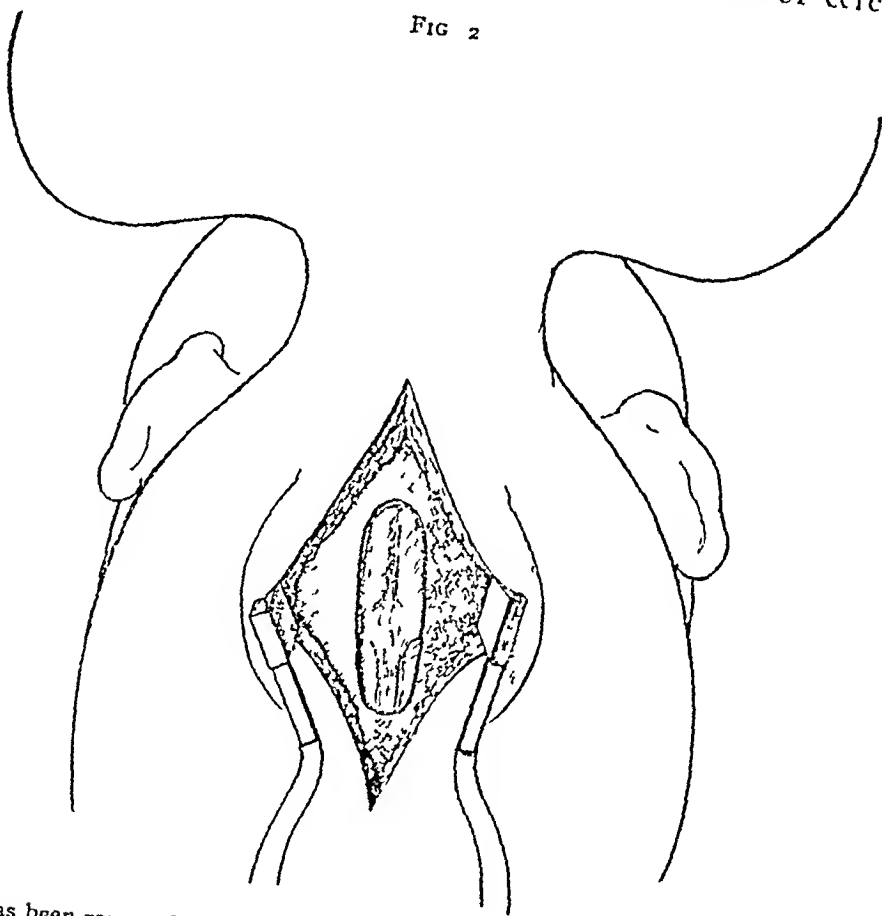
Though antedated by Gartner in the basic conception of this operation, and by Payr in an attempt to accomplish it, and notwithstanding the fact that the appended observations are based on the same facts and theories as his, the writer feels that it is justifiable to present a method of its accomplishment which seems much simpler in the technic of its execution.

#### B CASE REPORTS AND TECHNIC

*Drainage of the cisterna magna into a cranial sinus for congenital internal hydrocephalus. Recovery from the operation, much improvement for four weeks, return of original state, but*

exposed. The pressure in the cistern and sinus was to be taken. Then the long end of the vaseline-sterilized tube was to be passed into the sinus and the other end thrust through the membranes into the cistern. This would unite the two spaces. The tube was to be held in place by a suture. Hemorrhage was to be controlled by pressure of hot sponges. Loss of cerebro-

FIG 2



The bone has been removed to show the dura over the cisterna magna and the confluence of the sinuses

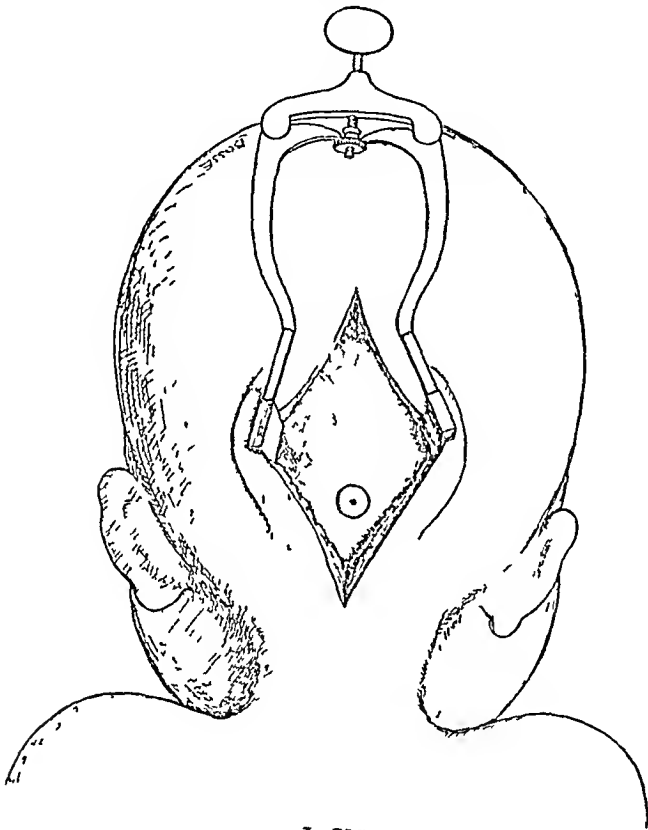
spinal fluid was to be prevented by digital pressure or by a purse-string suture about the tube, and any considerable loss made up by infusion of normal salt solution. The skin was to be tightly closed.

*Course of the Operation* (December 11, 1912) —Ether-anæsthesia by Dr. Lumhard, Dr. Moorhead and House Staff assisting. An incision, two inches long, was made in the middle line with its centre over the occipital protuberance. The periosteum with the muscles was reflected. A right parietal crani-

The shorter the tube the better. That rubber tubes and needles and silk sutures may be used in and about the vessels without clotting of blood has been too well established by Carrell<sup>4</sup> and others to need further mention.

The tube is prepared by being cut across obliquely and the sutures threaded through the ends as shown in the diagram. The object of the suture is to quickly pull the tube into the

Fig. 1



Median incision retraction of periosteum and muscles exposure of the bone, and position of the trephine opening

incision in the dura and fasten it there when in place. The tapering is to facilitate this procedure. The needles are the fish-hook pattern of Mayo. One is passed through both dura and arachnoid (which in this condition is pressed against the dura) so as to traverse the cisterna for a quarter of an inch, the other in a similar manner is passed through the occipital sinus or torcular. Before each needle is withdrawn, alongside of it is thrust a narrow knife about  $\frac{1}{8}$  of an inch wide to make

**Inferences** The tube should have been held in place by a suture in the dura. That a clot formed in it must have been due to insufficient preparation.

## PART II

### A. PHYSIOLOGY OF THE NORMAL INTRACRANIAL CIRCULATION, THE FORMATION AND DISPOSITION OF THE CEREBROSPINAL FLUID

In order to understand the facts and theories upon which the preceding operation is based, it is necessary to briefly review the conditions which prevail in the normal intracranial circulation and its attending phenomena.

The arterial blood supply to the brain is exceedingly free and is in direct relation to the heart without the intervention of any considerable turns or angles. The brain feels alterations in heart pressure very quickly and with small diminution of force. The blood is furnished to the brain by a mechanism designed to give it the maximum quantity, continuously and freely distributed. Especially is the blood supply to the choroid plexuses of the various ventricles so arranged as to guarantee at all times a free current of fresh arterial blood.

The venous return from the brain is by means of the various cerebral veins, which, grouped into two systems, pass to the cranial sinuses. The internal venous system eventually terminates in the straight sinus, while the surface veins end in the superior longitudinal sinus, chiefly. Beside these chief terminal outlets there are some other ones which are not necessary for our consideration.

Mention should be made of the mechanism which nature has provided at the base of the brain, the jugular bulb, which

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**NOTE**—"Exudate. Any adventitious substance deposited in or upon a tissue by a vital process or disease. Adventitious, accidental or acquired, not natural, not natural or hereditary, found out of the normal or usual place."

"Transudate. Any substance which has passed through a membrane."

the sutures were in place and all but two tied, when external pressure through the scalp effectually prevented any more loss of fluid. There was no drainage from the wound into the dressings, nor into the subcutaneous tissues.

December 11 ventricular puncture was done and  $2\frac{1}{2}$  ounces of fluid removed. The benefit following this relief of pressure only lasted for a few days.

December 26, the child's condition was hopeless. Beside the hydrocephalus, the child shows advanced marasmus. When the child was first admitted to the hospital the mother's milk was tested and found to contain less than  $1\frac{1}{2}$  per cent of fat. Artificial feeding was begun but has not accomplished anything.

CASE II—G B, female, aged six months. Admitted to the Red Cross Hospital, December 9, 1912. Referred to the writer by Dr I S Tunick.

The child was apparently normal at birth. Six days after birth the infant's right hand was pricked by a pin, infection followed, and after two weeks the baby's hand was operated upon. Four weeks later an attack of erysipelas began which lasted two weeks. Three weeks after this, or when 13 weeks old, the baby had convulsions attended with a rectal temperature of  $104^{\circ}$ . No diagnosis was made, but from this time the head began to enlarge. Up to the present, lumbar puncture has been performed six times with removal of from 2 to  $2\frac{1}{2}$  ounces at each puncture.

This infant, while having a very large head that it could not lift or move, was a very much more promising subject than the preceding one. Its general nutrition was much better, and it did not have the marked eye, nervous, and mental symptoms of the first case. In order that a communication between the two spaces might be established by a method easier and simpler than the one just given it was decided to use a silver cannula with obliquely sharpened ends, bent on a short curve to a right angle (see note).

It was to be used in this manner. The cisterna magna and the occipital sinus (or the torcular if necessary) were to be

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NOTE—The cannula had an internal diameter of  $1\frac{1}{2}$  mm. Its long arm was 1 inch and its short arm  $\frac{1}{4}$  inch. They were bent on a short curve to stand at right angles to each other.

However, as the cerebrospinal fluid is not lymph, its passage into the lymphatics even when under great pressure is almost *nil*. In the normal state this passage does not take place. In the child after the age of three years and thereafter the passage of the cerebrospinal fluid into the cranial sinuses is chiefly by means of the Pacchionian bodies. While the action of these bodies is most interesting and has been well described by Kocher,<sup>10</sup> they do not concern us at this time because in the *infant they are few in number, rudimentary, and functionless*. At this early time of life the cerebrospinal fluid passes directly into the cranial sinuses, chiefly the superior longitudinal. This fact is beyond question. The impelling factors determining this flow are the following:

- 1 The cerebrospinal fluid is a secretion from the choroid plexuses of the arterial system.

- 2 The pressure in the arteries is always higher than in the sinuses.

- 3 The pressure in the cerebrospinal fluid is below that in the arteries and always slightly above that in the sinuses. The flow therefore determined by differences of pressure is into the sinuses (Ballance<sup>11</sup>).

- 4 The specific gravity of the fluid (1005-1010) is below that in the blood (1059), the current determined by difference in the specific gravity of the two fluids is from that of the lesser to that of the greater. The fluid flows then into the blood stream.

- 5 The control of the passage of fluid into the sinuses is exercised at this early period of life by the open spaces between the cranial bones at the fontanelles, which are closed by an elastic, flexible membrane, whose rhythmic expansions and contractions vary with vascular, respiratory, and gravity pressures. They cease to functionate when the Pacchionian bodies begin to work.

- 6 Control over all these separate factors is exercised by the vasomotor system, so that the result of their combined function is to produce a constant intracranial tension. Slight variations, even, from this state are registered at once by

vein was torn across and bled freely, but was easily controlled by finger pressure. A small  $\frac{3}{8}$  inch tiepline was applied midway between the protuberance and the margin of the foramen magnum and a thin button of bone removed. The dura bulged into this small opening. The intracranial pressure of the cerebrospinal fluid was now taken and showed a record of 75 cm in vertical height. The pressure in the sinus was not taken, as I determined to utilize the parietal emissary vein for drainage purposes and did not care to prolong the operation merely to uncover the sinus and get its pressure. The long arm of the silver cannula was slightly bent so as to easily enter the emissary foramen, into which it was placed, and the other end pushed through the dura and arachnoid into the cisterna magna. The cannula was held in that position until the skin sutures were placed and tied and a firm dressing applied to the surface. The child was in fine shape when taken from the room.

*Course of the Case*—There was considerable loss of cerebrospinal fluid through the incision between the sutures for the first 24 hours. However, as everything seemed to be progressing nicely nothing was done to prevent it. On the thirteenth the wound was dressed. The flow of fluid was only small in amount from one end of the incision. This was checked by firm strapping. Nothing more was attempted, as the child appeared to be doing exceptionally well. During the following night it gradually became worse and by morning had a temperature of  $106^{\circ}$  F. From this time on until evening it became worse and died at 9 P.M. of the 14th, the cause of death, evidently, being due to a too rapid loss of fluid to the surface. This loss of fluid was apparent from the first, but the child was so well during the first 24 hours, and the flow of fluid seemed so little during the second 24 hours, that when too late to do anything it was realized that it had had its effect in determining a fatal ending.

Autopsy, only examination of the wound was permitted. There were no inflammatory evidences anywhere. There was no blood in the cisterna magna. It contained only a very little fluid. The lower end of the cannula had been displaced from the dural opening, but the upper end was in the emissary foramen. Its lumen was closed by a clot that did not reach to either end but seemed to be only at the angle.

into the basilar subarachnoid space,—the cisterna magna,—especially the foramen of Magendie, are widely open. *This space then becomes a component part of the great ventricular cavity.* The cortical parts of the brain are flattened out and pressed against the interior of the skull. The brain stem is not usually crowded into the foramen magnum.

Nothing abnormal may be found but this great collection of fluid. The condition is then called idiopathic, which really means that we do not know why it originates. At times a notable thickening is found in the ependyma covering the choroid plexuses. This has been interpreted by some as the *cause* of the collection of fluid from excessive secretion. But others assent with as much or more reason that this thickening is a *result* of such excessive secretion. The cause of the hydrocephalus may be due to an obstruction at the sinuses, as Cushing<sup>12</sup> claims, that prevents the fluid from flowing into the longitudinal sinus. That this is the chief causative factor is probable, but no direct proof is available to validate the statement, excepting this, that in the normal state large quantities of fluid may be caused to pass freely into the sinus without marked disturbance of the intracranial balance.

Various theories have been advanced indicating a pre-natal meningitis. In syphilis, this has been proved, but there is no evidence to show that meningitis is the cause in the other cases of congenital hydrocephalus. No trace of such inflammation is found at the postmortem.

Whether the hydrocephalus is the result of excessive secretion or of deficient elimination or both, the fact remains that there is an abnormal amount of fluid within the ventricular cavities of the brain, and that this excess of fluid produces a definite condition and series of symptoms that will result in the death of the infant, unless relief be afforded by art or very rarely by spontaneous cure.

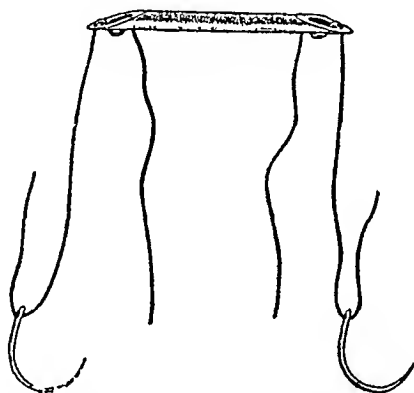
*Symptoms*—The infant's head is distended to abnormal proportions by the excess of intracranial fluid. This fluid may be under great pressure. In one of my cases it rose to a



is a veritable "plumber's trap" (Macewen<sup>8</sup>) By this method of construction a steady flow of blood is assured from the brain by the conversion of the pulsating arterial stream into a steady venous current

Beside these mechanical arrangements to equalize the intracranial pressure, the cerebrospinal fluid exercises a very important part This fluid is a true secretion furnished by the gland-like cells of the ependyma covering the choroid plexuses It is not lymph It is not an exudate or a transudate Its quantity is only enough to lubricate the

FIG 3



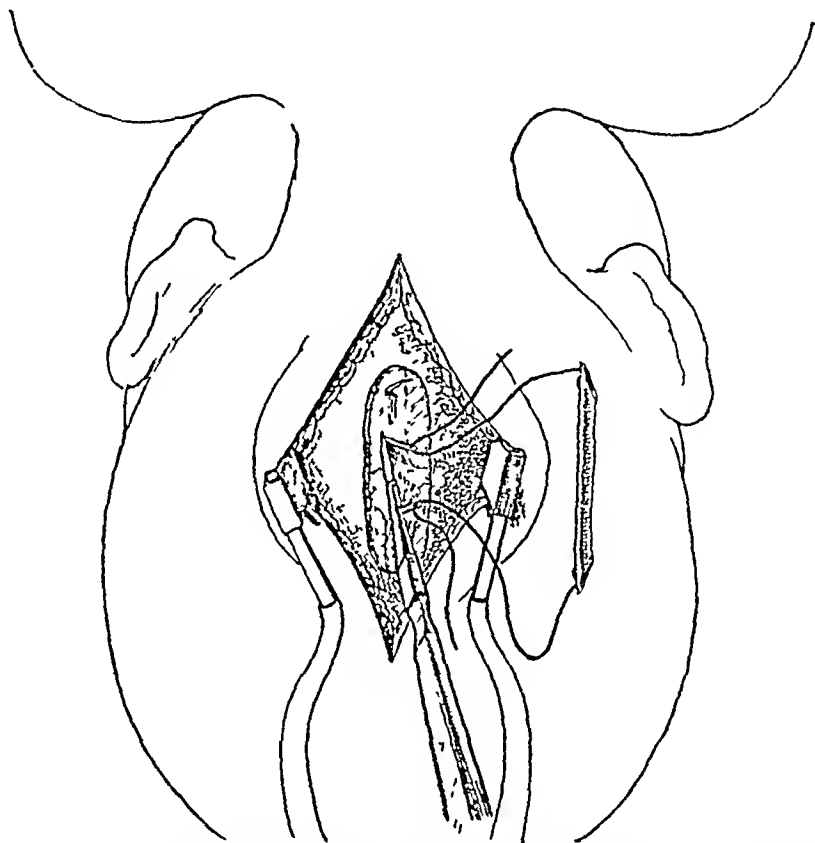
Enlarged drawing of the rubber tube to show the manner in which it is cut and the sutures attached The actual tube is 1.5 to 2 mm in internal diameter and in length to correspond to the space to be traversed The shorter it is the better Its length will be from three-fourths of an inch to twice this

membranes between which the brain is enclosed and permit free movement in a limited degree It varies in quantity from 60 to 80 c c (Howell<sup>9</sup>) Its course is from the lateral ventricles, through the foramina of Monro, the third ventricle, the aqueduct of Sylvius, the fourth ventricle, and the foramina of Key and Retzius, and especially the foramen of Magendie into the basilar subarachnoid space, the cisterna magna After filling the spinal canal, the cerebrospinal fluid courses upward over the surface of the brain to enter the superior longitudinal sinus There are some other sinuses into which the fluid passes, but they may be disregarded in this review There is another way in which the fluid may leave the skull under exceptional conditions, viz, by way of the lymphatics

Langenbeck,<sup>6</sup> in 1850, drained the anterior horn of the lateral ventricle by passing a trocar through the orbit

In 1888, Keen<sup>7</sup> laid down the rules for ventricular puncture from the side. His point is  $1\frac{1}{2}$  inches behind and the same distance above the level of the external auditory meatus. Keen also noted that the ventricle could be entered

FIG 5



A narrow knife is passed along the shank of the needle to cut a very short vertical incision into the cisterna magna (also, later into the sinus)

from in front by taking a point  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch at either side of the mid-line and one-third of the distance from the glabella to the superior Rolandic point. The bone must be trephined first in either procedure.

Ewart and Dickenson,<sup>6</sup> in 1891, varied puncture of the ventricle by forcing sterilized air in to take the place of the fluid.

For a detailed list of the operators and cases following these consult Kausch.<sup>2</sup> He states that he has collected from

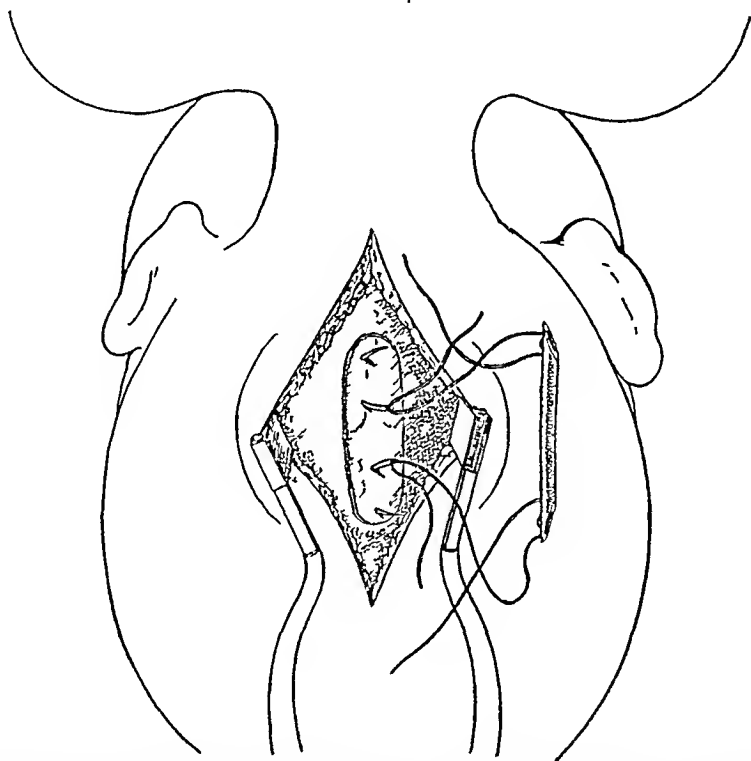
subjective disturbances, and greater variations later by both subjective and objective symptoms and signs

#### B CONGENITAL INTERNAL HYDROCEPHALUS

*Etiology*—The disease comes on early, at or soon after birth, usually before the third month

First, let us consider the condition that is found at autopsy

FIG 4



The needles are inserted one into the cisterna magna and the other into the longitudinal sinus. If the occipital sinus were large enough it should be selected if not the torcular, the longitudinal sinus, rarely

The cranium is enlarged, even to immense proportions. The fontanelles are widely expanded, and other spaces, not usually open, are present, as a separation of the various sutures so that the individual bones of the cranium may have very little connection with each other. The head seems like a great bag of water. The ventricular cavities throughout the brain are dilated, as are their normally small connecting foramina or channels. Those openings which lead

The average number of punctures was 17, varying from 9 to 32 in the shortest and longest cases

The smallest total quantity of fluid drawn was 205 c c, the largest, 889 c c, the average for the 9 cases was 487 He claims the following results

Case 1 Complete cure, with moderate hydrocephalus

Case 2 Satisfactory improvement

Case 3 Cured

Case 4 Complete cure, normal head

Case 5 Complete cure, hydrocephalus disappeared

Case 6 Improved

Case 7 Complete cure, hydrocephalus not disappeared

Case 8 Marked improvement, moderate hydrocephalus

Case 9 Scarcely any real improvement

He states that in the 10 years from 1899 to 1908 there were 183,044 admissions to the Children's Hospital, among which were 334 cases of hydrocephalus The first three years of life furnished the greatest number of cases, all varieties of hydrocephalus included For our purpose, his paper is incomplete because we do not know to what method of treatment the other 325 cases were submitted With a record of only nine cases out of this number, it suggests that he was very careful in the selection of the cases for lumbar puncture

His results substantiate one contention of mine, viz, that *no matter what form of treatment is pursued, it must extend over a long period of time, i e, until the Pacchionian bodies reach their development and begin to functionate*

The success of lumbar puncture depends upon a free communication between the cranial and spinal subdural (subarachnoid) spaces If the foramen of Magendie or the foramen magnum is blocked by an inflammatory exudate, lumbar puncture is clearly futile and death often follows from a "cooking up of the foramen magnum by the brain stem"

(c) Puncture of the corpus callosum Anton and V Bramann,<sup>2</sup> in 1908, opened the skull near the mid-line, punctured the corpus callosum, then closed up the external

vertical height of 75 cm in the manometer This pressure, beside deforming the head, produces other symptoms, as displacement of the eyes with staring, strabismus, nystagmus, loss of accommodation, and even blindness The scalp is thin, veins dilated, face shrunk The head is so large that the child cannot lift or turn it There is general emaciation even after the best regulated diet The arms are flexed and the hands clinched There may be contractures, but seldom paralysis The child is very restless and cries continuously in a peculiar purposeless tone (Chapin and Pisek<sup>13</sup>)

If the intracranial pressure is not relieved, death usually ends the struggle Hydrocephalus may become stationary, but most cases die during the first year, few live beyond the age of three, and very few to adult age

*Differential Diagnosis*—Rickets is the chief disease But the square head with the other symptoms of rickets should make the distinction easy However, both diseases may exist in the same individual If a tumor is present, its diagnosis is very difficult and may be impossible

*Prognosis*—Distinctly bad

*Treatment*—"Medical treatment is of little avail" (Chapin and Pisek) The treatment must be surgical, but thus far this has been almost hopeless

### PART III

#### A SUMMARY OF THE VARIOUS METHODS SUGGESTED AND USED IN THE TREATMENT OF HYDROCEPHALUS, WITH THE NAMES OF THE ORIGINATORS AND A CRITICISM OF THE OPERATION

I *Intermittent Drainage*—(a) Of the lateral ventricle  
 Ventricular puncture It is stated (Bryant and Buck<sup>7</sup>) that Hippocrates tapped the ventricles for hydrocephalus Stevens,<sup>6</sup> in 1745, suggested trephining in the case of Dean Swift From this time to the present, ventricular puncture has been used by many surgeons for the treatment of hydrocephalus and also condemned by as many more

from speedy infection Of all the cases reported, only two recovered and one was improved

Le Cat (cited by Ricketts), October 23, 1744, punctured for hydrocephalus Kausch<sup>2</sup> says the tube was permitted to remain in place If this is so, Le Cat was the first to drain the ventricle to the surface for any length of time This method is so uniformly fatal that it is no longer used

(b) Subcutaneous drainage of the lateral ventricle According to Kausch, C Wernicke, in 1881, was the first to suggest drainage of the lateral ventricle into the subcutaneous tissues The idea upon which this was based was to prevent the almost certain infection which followed the open drainage This method had a short life It was soon found that while temporary benefit might follow its use, the original condition soon returned This was due to the failure of the fluid to be absorbed from beneath the skin, fascia, or muscle on account of the exits for the fluid soon being closed up by plastic exudate and a regular cyst formed This method has also been given up as unreliable, inefficient, and dangerous

(c) Drainage into the subdural or subarachnoid space (For this consideration these spaces are practically one) While it is clearly evident that for the particular type of hydrocephalus we are studying this form of treatment is perfectly useless, inasmuch as the ventricular and subarachnoid spaces are parts of the general hydrocephalic cavity, yet in order to complete the subject the following will be noted In 1893 V Mikulicz first suggested this form of drainage, which he designated as permanent internal drainage of the lateral ventricle This method is clearly indicated only in the acquired variety of hydrocephalus where there has been a stoppage to the flow of the fluid from one ventricle into another or into the subarachnoid space Numerous are the operators and many the cases submitted by them to this form of procedure, with uniformly bad results All sorts of drainage material has been used, as hair, catgut, silkworm-gut, tubes of rubber, glass, copper, silver, and gold Kausch

among the numerous cases reported only six cases cured and two improved. These cases are so few that they might have just as well been the result of "spontaneous cure" as due to the ventricular puncture. The objections to this operation are infection, which may result in connection with the first attempt or only after many punctures have been performed, sudden death from too free removal of the fluid or later death from a "cerebral disturbance" due to the same cause, return of fluid and death from the original disease. The operation is only used at present as a palliative measure for the first few weeks of a very young patient or as preparatory to more radical measures. Not more than 25 to 75 c c of fluid should be removed at any one sitting. This should not be repeated more than twice in one week, or once in two weeks.

(b) Of the spinal canal, *i e*, lumbar puncture

Puncture of the spinal canal for hydrocephalus was first performed by Quincke<sup>14</sup> in 1890, but the spinal canal had been previously entered by Corning<sup>15</sup> in 1885 for the introduction of drugs and by Wynter<sup>16</sup> in 1889 for drainage of acute meningitis. However, owing to the very clear and complete description of this operation by Quincke, it has gone by his name ever since. Many operators have subjected numerous cases to this method of treatment with very little success. Archibald<sup>7</sup> says that "lumbar puncture is not of any permanent benefit."

The writer found almost no favorable results attributed to lumbar puncture except by Bókay<sup>5</sup> in 1910. His results in the treatment of nine cases of congenital internal hydrocephalus are so exceptional that the following brief summary of them is appended.

The average age at the beginning of Bókay's treatment was  $6\frac{2}{9}$  months. The youngest infant was 3, the oldest 9 months. The time of treatment varied from 4 months in the shortest case with a "perfect cure" to  $4\frac{1}{2}$  years in the longest case with the same result, and for the same length of time in another case with practically "no improvement." The average duration of treatment was 25 months.

the aqueduct of Sylvius was completely closed. The cerebral cortex was only 2 to 3 mm thick. In the abdomen the drainage tube was found clear, and fluid slowly escaping from it. Kausch thinks that this method of drainage may be easily controlled so that such sudden emptying of the ventricles may not occur. He says that the peritoneum freely absorbed the large quantity of fluid emptied into it.

In 1910, Hartwell<sup>18</sup> accomplished the same object by uniting the lateral ventricle to the peritoneal cavity by means of a silver wire, provided with bulbous ends, that was passed subcutaneously from the mastoid region down the side of the neck, over the clavicle, down the midclavicular line, and into the peritoneal cavity just beneath and outside of the right border of the liver. In this case the result was favorable so far as establishing drainage was concerned. The first wire was too heavy and the movements of the neck finally broke it. However it was apparent that a definite cicatricial tube had formed around the wire through which the fluid flowed. The first wire was replaced by a smaller one, and drainage kept up intermittently until the child's death some two years later. Autopsy showed the cause of death to have been due to a tumor in the aqueduct.

Hartwell says that the idea was not original with him, as he got it from Dr. Robert Abbe, in part at least. This method is worthy of further trial. There are so few cases recorded that no conclusions can be formed at this time as to its real value.

If one were to attempt this operation, I would suggest that, instead of tube drainage or the silver wire used by Hartwell, the silver wire cable devised by Lihenthal<sup>19</sup> be used. This is sufficiently strong and very flexible, and may be obtained in small gauge.

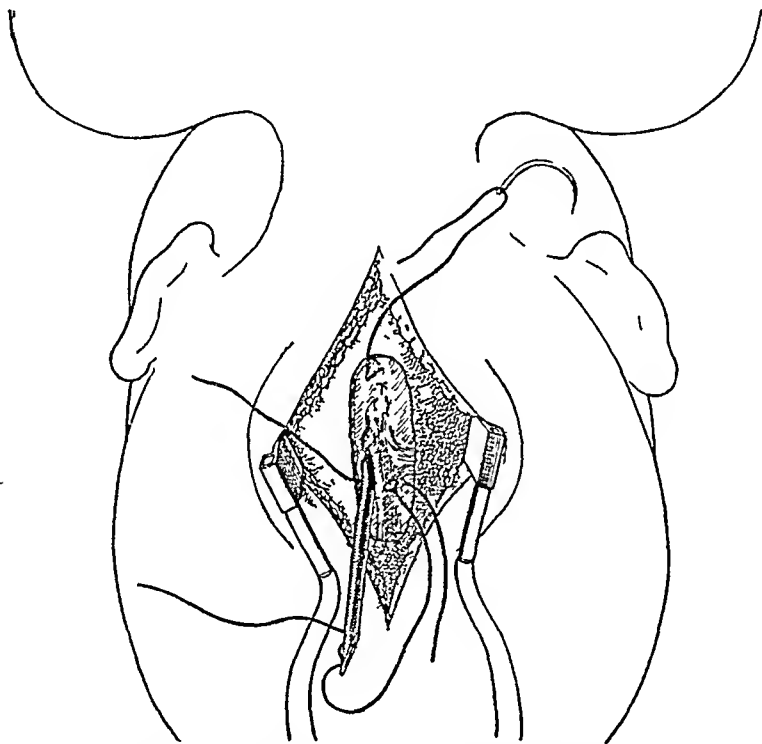
(e) Drainage of the lateral ventricle into the temporal vein. In 1908, Bier<sup>3</sup> followed Gartner's suggestion (see under Payr's operation, below), and transplanted a portion of the temporal vein into the lateral ventricle through a trephine opening in the side of the skull. The patient died



wound It is evident that this method is not applicable to the treatment of this form of hydrocephalus that we are considering, inasmuch as it merely establishes a connection between different parts of the same hydrocephalic cavity

2 *Continuous Drainage*—A Of the Lateral Ventricle  
(a) To the surface

FIG 6



The incision has been made into the cisterna magna the needle and suture pulled through and the tube shown ready to be passed into the incision

Pollock<sup>2</sup> was probably the first to perform drainage of the lateral ventricle, in 1884 He used a drainage tube He was followed by Zenner,<sup>2</sup> in 1886, by E V Bergmann in 1887 and by Keen<sup>2</sup> in 1888

In the first cases a drainage tube was used The fluid escaped so rapidly that death occurred very soon This led Keen to use horsehair for drainage material Silk-worm-gut, catgut, rubber tissue were used by different surgeons with uniformly fatal results from too rapid escape of the fluid or

case, third operation, died two hours after the operation. Further consideration of this method will be deferred until later.

*B* Continuous Drainage of the Spinal Canal (a) To the surface In 1873, Paget<sup>3</sup> resected the third and fourth cervical arches and drained "without result"

All forms of continuous drainage to the surface by means of tubes, laminectomy, etc., have been abandoned, as previously stated, on account of the escape of fluid being too rapid and infection sure to follow

(b) Into the retroperitoneal tissues Nicoll<sup>2</sup> in 1899 suggested draining the fluid from the spinal canal into the retroperitoneal tissue, by the resection of one or both transverse processes of the second lumbar vertebra, blunt separation of the muscles, and drainage by means of a decalcified bone tube, or by using temporarily a glass or rubber tube. This plan has nothing to commend it over numerous other plans. The objection is not so much to the technical difficulties as to the fact that fluid in abnormal situations soon develops a cyst and absorption ceases

(c) Drainage into the peritoneal cavity Ferguson<sup>2</sup> in 1898 published the first case of this kind. He resected a portion of the fifth lumbar arch, drilled a small hole through the body of the vertebra into the peritoneal cavity, and established a connection between this space and the spinal canal by means of a loop of silver wire. His first case died at once, apparently from a too sudden loss of spinal fluid. His second case was improved, but died three months later of bronchopneumonia.

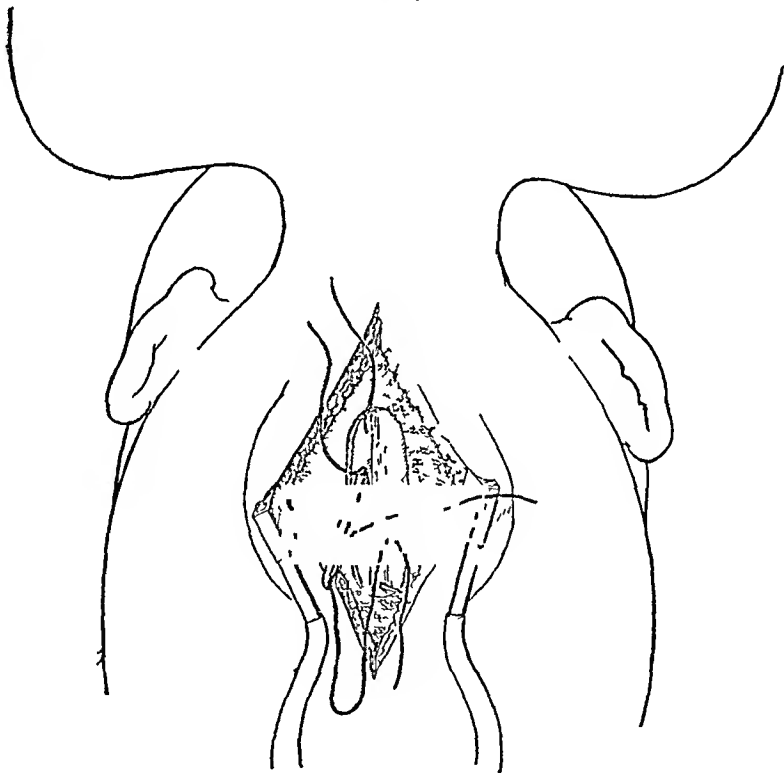
Damas<sup>2</sup> later suggested the resection of two sacral arches and connecting the spinal canal with the pouch of Douglas. He had not tried it on the living.

In 1908, Cushing<sup>7</sup> established permanent drainage between these two spaces by adding a laparotomy to Ferguson's technique and using a silver cannula consisting of two portions, similar to an elongated Murphy button. He reported a considerable measure of success. Fowler<sup>22</sup> in 1909 reported three cases

records only one case that lived as long as seven months and one other that lived for six weeks

However, E Wyllis Andrews,<sup>17</sup> in 1911, reports a case in which he operated for acquired internal hydrocephalus by establishing a communication between the lateral ventricle and the subdural space by means of a glass tube. While there have been many modifications in the technic, the results have been

FIG 7



The tube has been passed into the cisterna magna and the suture is ready to be tied

uniformly disappointing. The causes of death have been too rapid escape of fluid, infection, return of original condition, marasmus.

(d) Ventriculoperitoneal drainage. In 1905, Kausch<sup>2</sup> performed this operation by uniting the lateral ventricle with the peritoneal cavity by means of a small rubber tube, placed subcutaneously. Death followed in 17 hours from too rapid escape of the fluid. Autopsy showed that the entrance into

laterally over the cerebellar lobes and instituting drainage with difficulty if at all. All their cases were suffering from meningitis.

Roswell Park<sup>6</sup> in 1893 was the first to drain the cerebellar fossa for hydrocephalus. His technic and Parkin's are practically identical.

Glynn and Thomas<sup>6</sup> in 1895 trephined and opened the fourth ventricle with recovery of the patient.

All these attempts at draining this region were to the surface. If death did not result from too rapid escape of fluid it usually followed later from infection.

(f) Drainage of the cisterna magna into the cranial sinus. (Devised and performed by Haynes, Oct. 22, 1912.) Case recovered, improved steadily for a month, followed with return of symptoms due to probable closure of the opening into the occipital sinus. Case still living but slowly succumbing to marasmus. Second case died three days after the operation of connecting the cisterna magna with a parietal emissary vein from loss of cerebrospinal fluid through the incision, between the sutures.

(g) Other measures. Treatment by seton, injection of iodine, by galvanopuncture, compression of the head, and by drugs require only passing mention.

(h) Indirect treatment. Harold J. Stiles,<sup>26</sup> reasoning that hydrocephalus is due to an over-secretion of the cerebrospinal fluid, has ligated both internal carotids, at different sittings. He reports favorable results (1911).

Ransohoff<sup>26</sup> reported two cases of carotid ligation with "most gratifying results." Frazier<sup>26</sup> also stated that a recent case of his seemed to be benefited by the operation. These cases are too recent to show final results. Later reports will be awaited with interest.

#### B CRANIAL VERSUS SPINAL OPERATIONS

In selecting an operation for the treatment of hydrocephalus, we naturally have to decide at first between the spinal and the cranial routes. Any spinal operation

five days later. The autopsy showed that the transplanted vein was necrosed and thrombosed. Later, Schmieden<sup>3</sup> performed the same operation, but the result is not stated.

Kanavel,<sup>20</sup> in June, 1909, attempted a similar operation. He utilized "a large vein running up the side of the child's head." The vein was freed and thrust through an opening into the dura and sutured in place. The child did well for ten days, when the vein became occluded and the fluid reappeared. The child died a week later.

Carl Beck<sup>21</sup> states that four years before Payr published his cases he had tried the same method described by Kanavel. The patient died. At a later time he resected the external jugular vein and transplanted it. The result was gratifying for some time, but after six months there was the same symptom complex as before.

Regarding the plan to drain the ventricle into the veins of the neck, further work along this line may give more encouraging results than the few attempts in the past have shown. If the plan is feasible and desirable, I would suggest that the communication be made between the occipital vein and the cisterna magna for reasons of avoiding the cortex of the hemisphere and its attending traumatism. I have not even worked the technic out on the cadaver, and merely throw out the suggestion in passing.

(f) Drainage of the lateral ventricle into the superior longitudinal sinus. In 1895, Gartner<sup>2</sup> asked if it were not possible to establish a communication between the hydrocephalic cavity and the lymphatic or the venous system through a cranial sinus or by means of a vein of the head.

Payr,<sup>3</sup> in 1907 (December 19), was the first to attempt to put Gartner's suggestion into practice. He used a portion of the long saphenous vein to establish a communication between the cavity of the lateral ventricle and the superior longitudinal sinus. He performed this operation twice on one patient that lived for three months after the second

by Stiles is too recent to be judged at this time. His claims are worthy of very careful investigation, and time alone will prove the value of this treatment. Whether his contention is true or not, that the disease is due to an over-production of fluid, it has no bearing on the case so long as he gets cures by cutting off the excess of blood to the brain. That this may result in other less desirable effects, as arresting the development of the brain itself, has not been determined at present.

We come, then, to a consideration of the treatment of hydrocephalus by direct attack upon the disease itself in the cranium. Of the methods proposed we may dismiss from our consideration all but the following: (1) internal drainage, (2) ventriculoperitoneal drainage, (3) ventriculosinus drainage, (4) cisterna magna and sinus drainage, (5) cisterna magna and peritoneal drainage, a suggestion.

1 In reference to internal or ventriculo-arachnoid drainage, as this is clearly limited to the acquired variety of hydrocephalus its consideration is beside our present purpose. We may say this, that it has been successful in a few appropriate cases.

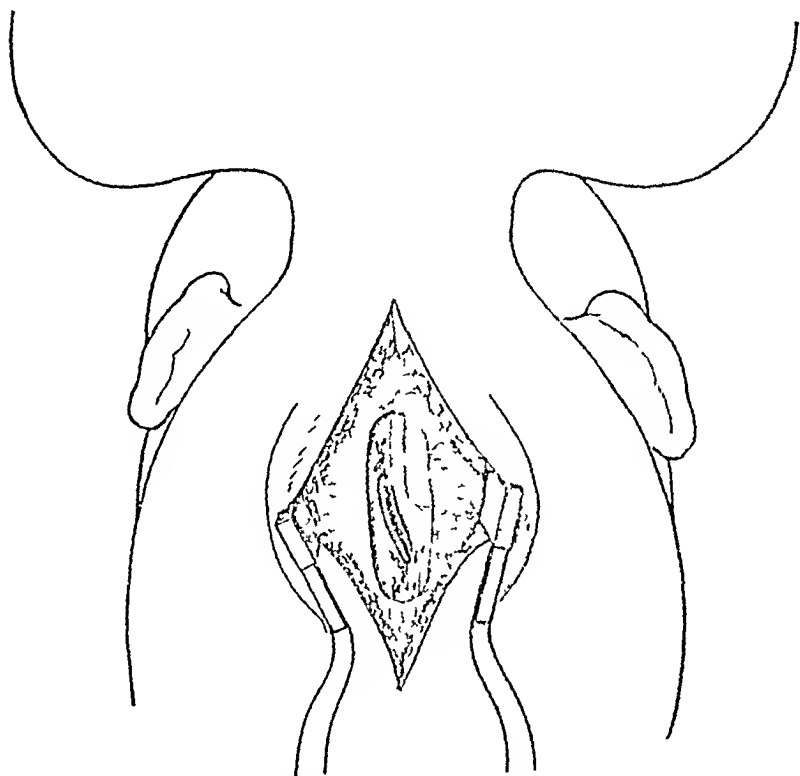
2 Drainage of the ventricles into the peritoneal cavity has to the present time given the greatest promise of eventually proving of real value. The use of a fine silver wire, by Hartwell, or the silver wire cable of Lihenthal, overcomes many of the disastrous difficulties in any operation upon this class of cases.

Plans 3 and 4 will be taken last.

5 Cisterna magna and peritoneal drainage. In connection with drainage of the ventricles into the peritoneal cavity, these thoughts came to me. The chief danger in any of these hydrocephalic operations is death from sudden loss of fluid. Now if this plan of treatment can be carried out without such attending risk, the results should be correspondingly improved, therefore, I am led to make the suggestion that, if there is no block within the intracranial ventricles or their channels of communication, the cisterna magna should be

exposed by a trephine opening  $\frac{3}{8}$  of an inch in diameter, midway between the margin of the foramen magnum and the occipital protuberance, in the middle line, that Lilienthal's silver wire cable of fine size be passed by the writer's dural needle through the membranes so as to traverse the cistern, that its short end be twisted around the long part of the cable,

FIG 9



The operation of inserting the tube is shown completed. The bone detritus may be packed into the gap and the skin tightly sutured.

which then is passed beneath the skin into the peritoneum over the surface of the liver on the right side. It would seem that this would accomplish relief from two main difficulties: first, prevent the sudden initial escape of the fluid and death; second, so gradually conduct the fluid away from the head that the intracranial pressure would gradually subside, a return to normal be permitted, and that it would functionate until the Pacchionian bodies were developed and took up the work permanently.

It would be interesting to find out whether the existence of a true joint here disputes our theory (*i.e.*, the formation of fibrous tissue which is immune) or whether, as in the ordinary cured tuberculous hip, there is really no joint at all and the bones are simply tied together by fibrous tissue

Such a theory as that of Ely is a decided step forward in the better understanding of tuberculous joints, if it is found to be borne out by future investigations

I do not attempt to criticise Ely's views on the subject, but merely to point out that an elbow may be completely cured of tuberculosis and yet not exhibit obliteration of the joint cavity and its replacement by fibrous tissue

During the present year M. M., a female subject aged fifty-nine, was delivered to the anatomical department of the University of Manchester for purposes of dissection. As the body showed tubercular lesions and also the scar of old operation on the right elbow, it was handed over to the department of clinical anatomy for investigation

Examination showed that there were active tubercular lesions in the right tarsus and the right side of the frontal bone. Considerable necrosis had occurred in the latter area and death was due to an abscess of mixed infection in the right frontal area of the brain. There was no sign of phthisis in the lungs, and the pleuræ showed complete absence of adhesions. Apart from the elbow the body exhibited no lesions worthy of note other than those just mentioned

The patient had, at some previous date—which unfortunately was not ascertained in the hospital—suffered from tuberculous disease of the right elbow-joint and had undergone an operation for excision, concerning which no further details could be obtained. The operation had been entirely satisfactory. The disease had been completely eradicated, and the patient possessed a flail elbow, the arm and hand being still of service to her. The incision used had been a longitudinal one on the posterior and inner aspect of the joint—parallel to the course of the ulna nerve. This incision had been modified to a bayonet type by a smaller transverse cut on the extensor surface at the level of the lowest portion of the humerus. On making longitudinal sections of the



free end of the vein, a cuff having been turned back so as to bring the intima outside, is inserted and fastened in place by fine silk sutures. The flap of dura is accurately sutured in place and the osteoplastic skin flap similarly treated.

Objections mentioned by Payr. That it may not be possible to secure a portion of vein of sufficient length or free from pathological changes. That in numerous cases of hydrocephalus the superior longitudinal sinus is wanting or is obliterated by inflammation or thrombosis. That it may be impossible to complete the operation on account of severe hemorrhage. That the anastomosing vein may be compressed by faulty suturing, or it may be implanted in the wrong direction. That the vein may necrose as a result of lack of nutrition, or from mechanical, thermal, or chemical disturbances. That the sinus may become thrombosed, or a clot form in the vein. That the anastomosing vein may be forced out of the ventricle or its lumen closed by prolapsed brain tissue. That secondary infection may occur. A contra-indication for drainage into the sinus is any inflammatory process in the ventricular cavity, as cerebrospinal meningitis, tubercular meningitis, and he names several other conditions. A biochemical test must be made of the cerebrospinal fluid drawn by ventricular or lumbar puncture. Finally, he says this technic should not be attempted in hopeless cases.

#### PART IV

##### A SUMMARY OF THE FACTS UPON WHICH DRAINAGE OF THE HYDROCEPHALIC CAVITY INTO THE CRANIAL SINUSES IS BASED

- 1 Congenital, internal hydrocephalus appears at or soon after birth
- 2 The condition is due to an excess of fluid in the skull
- 3 Normally the cerebrospinal fluid is always at a slightly greater tension than the blood in the venous sinuses
- 4 In hydrocephalus this difference in tension may be more than ten times that of the normal, as my case demonstrated

4 In reference to Payr's operation. It is based upon the same reasons and facts as that of the writer. These arguments will be left to be considered after the operations themselves have been criticised.

Payr's Operation —An omega-shaped flap of skin and bone is formed crossing the middle line near the bregma. Its base, 2 to 3 cm wide, is placed a finger's breadth at one side of the mid-line. This osteoplastic flap is reflected, and a U-shaped flap of dura turned back, exposing the superior margin of the hemisphere. A long, small, graduated needle is used to determine the thickness of the cortex, and Payr says it is advisable to allow a portion of the cerebrospinal fluid to escape so as to relieve the stasis in the veins of the pia and prevent any considerable hemorrhage from the dural flap or the cortical surface. During the work upon the head, an assistant excises a portion of the long saphenous vein about twice the measured distance to be traversed, as vessels shrink fully fifty per cent when removed from the body. This portion of vein should be wrapped in gauze moistened with physiological salt solution, and kept at a temperature of  $37^{\circ}$  C over a water bath. The distal and peripheral ends of the vein should be marked.

An aluminum trocar, 2 to 4 mm in diameter, is passed into the ventricle, some more fluid is allowed to escape. With a bayonet-shaped probe the distal end of the vein is passed through the trocar into the ventricle and the trocar removed. The vein should project slightly into the ventricle. The vein is held in place by a fine suture through the pia-arachnoid and itself. Too sudden escape of cerebrospinal fluid must be guarded against or severe collapse, arrest of respirations, also inspiration of air into the ventricle may occur. Often immediate death follows sudden escape of the fluid.

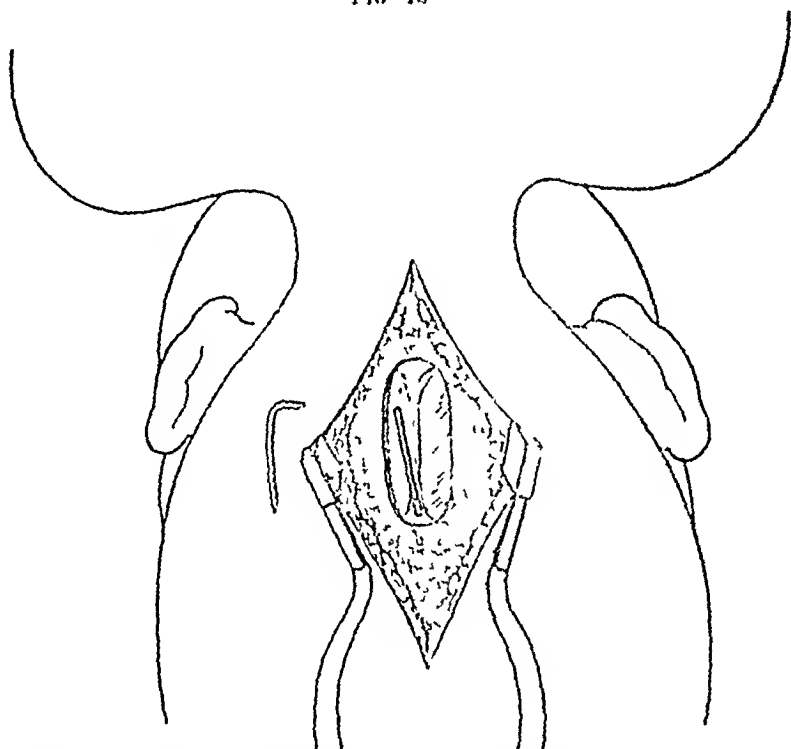
The longitudinal sinus must be exposed for 2 to 3 cm in order to accomplish provisional hæmostasis. The presence of lacunæ laterales must be noted and avoided. Hemorrhage is prevented by Payr's special clamp, by his inflatable rubber bulbs, or by elastic ligatures around the sinus.

A narrow incision is made into the sinus, into which the

for the blood to escape from the sinuses into the hydrocephalic cavity. Fluid cannot flow up hill nor from a vessel of lesser into one of greater pressure.

10 Any current flowing through a tube of larger diameter will act by suction to draw into its circulation the fluid from an adjacent space communicating with it by a tube of smaller dimension, no matter whether the pressure in the adjacent

FIG. 10



A silver cannula is used in this instance. Its dimensions are internal diameter 1.5 mm., length of long arm about an inch and of the short arm, one quarter inch. The ends are ground obliquely. In the diagram the occipital sinus is shown as the site of drainage, the trepan may be used if this is too small or is wanting.

space be at the same or a higher or a lower degree. This fact is demonstrated by the common injecting pump.

11 One concrete fact proves more than pages of argument. Payr states that in his cases autopsy showed there was not even a drop of blood in the ventricles. This, too, in spite of the fact that in one hemisphere there was a ragged hole  $3 \times 1$  cm. Neither was there any blood found in the case where from loss of fluid the cortex had collapsed during the operation.

Further, in the personal case reported where I believe drainage was established into the occipital sinus there were no signs of internal bleeding. Also, in my case where a silver tube was used to connect the cisterna magna with the longitudinal sinus by means of the parietal emissary vein, there was no blood found in the former space, as shown at the post-mortem examination.

12 The cerebrospinal fluid is isotonic with the blood, blood escaping into this fluid does not coagulate (Archibald)

13 There can be no doubt but that the thin sheet clot of small pial hemorrhages is ordinarily absorbed without causing symptoms and leaving trace (Archibald)

14 Even if a small amount of blood should escape into the cisterna magna, Archibald says, "With blood at the base of the brain there will be more or less disturbance of consciousness, from stupor to coma, with headache, usually severe, and with perhaps some slowing of the pulse and some rise in blood-pressure. The symptoms are not alarming, and it is easily seen that they will disappear without interference." If this is the case in a normal individual, how much quicker would the blood disappear in a hydrocephalic case in which the cerebrospinal fluid was at a tension greater than normal and in which there was a channel through which the bloody fluid might escape into the sinuses.

15 In the infant the fluid passes directly into the longitudinal sinus. Under experimental investigations it is found that very large quantities of artificial cerebrospinal fluid will leave the skull by way of the sinuses.

16 In hydrocephalus the cerebrospinal fluid is normal to all biochemical examinations.

17 The theory that the excess is due to an over-secretion of fluid is hardly tenable and not demonstrated, even by the results of carotid ligation. The block is at the entrance to the sinus. What that block consists in no one knows. If there is some passage of the fluid into the sinuses in hydrocephalus must be admitted. The result then of carotid ligation is merely to reduce the output of fluid so far below the

normal, that the smaller quantity of fluid secreted after this operation is taken care of by the diminished excretion at the sinus

18 There usually is no interference with the passage of fluid from the ventricles into the cisterna magna in congenital hydrocephalus. As a matter of fact the passages are more widely open than normal, the cisterna magna is then a true part of the hydrocephalic cavity, and drainage from this region will be as effective as from the ventricular portion.

19 The simplicity of drainage of the cisterna magna into the sinus, when contrasted with any other form of ventricular drainage, is apparent from a study of the operative technique in the several operations.

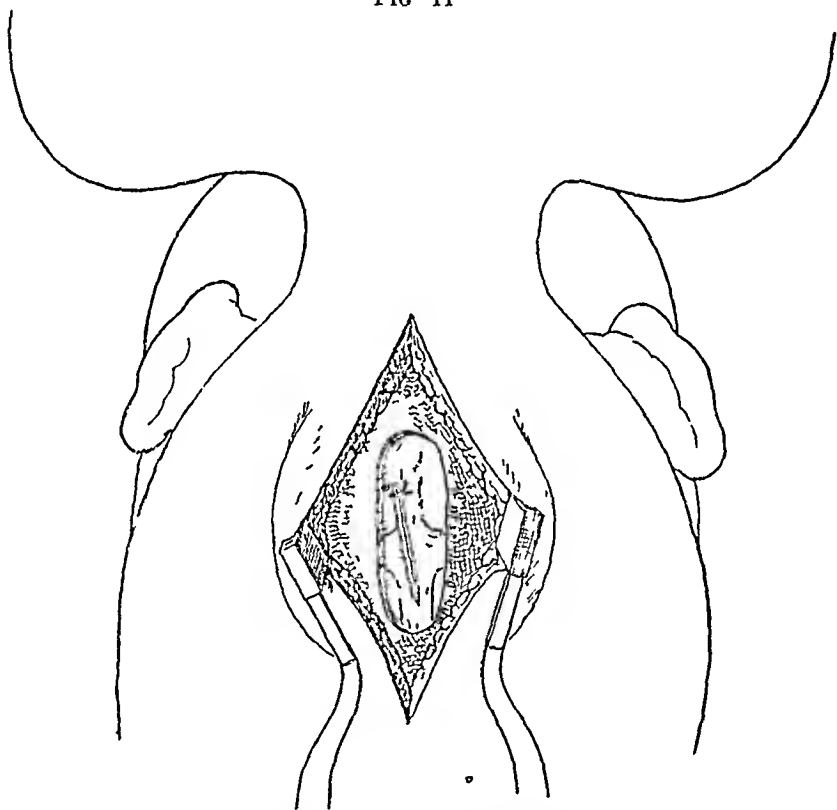
20 Cisterna magna-sinus drainage being simpler than ventricular-sinus drainage and without the drawbacks of the latter operation, is to be preferred when this type of drainage is deemed advisable. The following difficulties and operative measures are not encountered: (a) The dissection for drainage use of a portion of a vein, and keeping it viable until used. There are numerous trifling incidents which might render the vein soon impermeable after the work had been completed. Many more risks attach to the technique of successful venous transplantation than do to the insertion of a tube, rubber or silver. (b) In the cisterna drainage the dura is not reflected at any point and the brain is not exposed. Exposure of the cortex is attended with some risk, however, this may be overcome, but collapse of the brain from loss of fluid is not only fatal to the success of Payr's operation, it is fatal to the patient. In cisterna drainage the loss of fluid is under the absolute control of the operator during the operation. In both operations, if it were necessary, physiological saline solution might be injected into the interior of the brain. (c) There is wounding of the cerebral cortex in Payr's drainage and the dangers of hemorrhage from such source. There is also danger of damage to the choroid plexuses from the tube used for ventricular puncture.

21 After a careful consideration of the operation of Payr, it is the writer's opinion that while it is right in principle it is

too severe and difficult in practice. The difficulties in the way of carrying out the steps of his technic are almost insurmountable with the preservation of a drainage scheme and with a living patient.

22 There is an automatic regulation of the flow of fluid into the sinus in Payr's and the writer's operation that must not be lost sight of. One of the chief causes of death, found

FIG. II

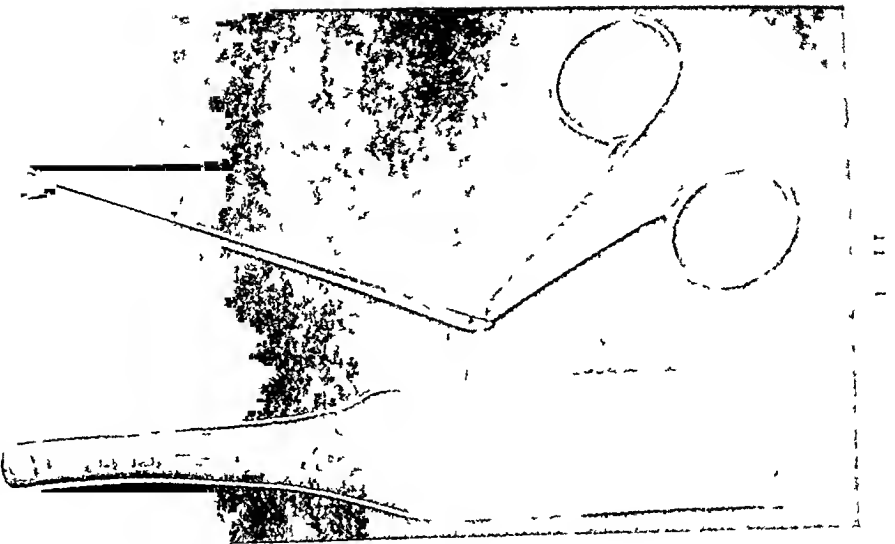


The operation is completed by placing a suture across the tube to hold it in position. The wound is closed as in the previous method.

after any operation either upon the spinal canal or cranium, is the too sudden and too free and continuous loss of cerebrospinal fluid. Now with cisterna-sinus drainage, starting with a considerable difference between the pressure within the hydrocephalic cavity and that in the sinus, as soon as they had become equalized the flow of fluid would automatically cease, the fall of pressure in the ventricles would be at least no lower than that in the sinus, and the fatal collapse of brain and patient, the so common final picture with too rapid escape of

must be determined. The results in 22 dogs are as follows: 4 died after an average of three days of evident traumatic encephalitis; 1 died of acute lobar pneumonia after two days; 3 died after an average of 23 days of distemper pneumonia; 4 died after an average of 15 days of basal meningitis, 1 died after 38 days, showing at necropsy a thrombosis affecting the hemisphere opposite the field of operation, with a large abscess of the base, 2 died after an average of ten and a half days, the cause of death being uncertain, 2 met accidental deaths after an average of  $23\frac{1}{2}$  days, 5 lived for months. None of these dogs showed any immediate symptoms peculiar to the operation, no peculiar gait, nor position, no tremors, nor any other clinical symptom, recovery was prompt and without complications.

The method of approach is through an incision about 2 inches in length, perpendicularly over the centre of the zygoma—the zygoma forming, as it were, a base line with the two-inch incision extending perpendicularly to such a base line. The zygomatic arch is removed, the coronoid process of the mandible resected, and the base of the skull approached in a direct line. The skull is trephined and the hole somewhat enlarged, and after opening the dura, the brain is carefully elevated by a suitable retractor. The hypophysis is then removed by a special loop forceps (Fig. 1) which enables the operator to grasp the gland and generally remove it in two pieces, the anterior lobe in one piece and the posterior lobe separately. The wound is closed without drainage. With a strong light the field of operation is ample and no difficulty is encountered. This approach, which has been used before, was chosen because the Paulesco-Cushing incision with its extensive removal of the skull seems unnecessary and in our opinion exposes too large an area of the brain to the compressive action of the large masseter muscles. In several instances the operation has failed because of an atypical course of a large branch of the pterygopalatine artery. This branch, ordinarily not in the field of operation, has now and



Brain retractor, from beneath, showing rounded edges Loop forceps, for grasping the hypophysis



Dog No. 1 Lived 38 days

Shows what must be complete removal of all hypophyseal tissue by the extensive area of softening



Fig. 1



Dog, No. 1 Area of tumor

Fig. 2



Dog 19 Atrophy of testicles On the right testicle removed at time of hypophysectomy On the left companion organ fifteen days later

5 The current in the cerebrospinal fluid determined by the normal difference of pressure into the sinuses

6 One of the chief reasons for the development of hydrocephalus is the failure of the fluid to take its normal course due to some block at the entrance into the sinus

7 The current determined by osmosis is from the cerebrospinal fluid to the venous blood, because the specific gravity of the former is so much lower than that of the latter

8 There is no appreciable passage of the cerebrospinal fluid into the lymphatic system in the normal nor in the abnormal state, as the fluid is not lymph but a true secretion

9 The current of blood in the sinuses is toward the heart, with an equalizing mechanism at the jugular bulb to maintain an even pressure in the sinuses. This pressure may, however, at times be negative. It may also be raised by an increase of intrathoracic tension, as in coughing, straining, also by changes of position from the head-up to the head-down positions. *But one should remember that there are two columns of fluid passing to the head, the arterial and the venous*, and that pressure in one as a result of a general cause must exert a similar pressure in the other, and further that as the arterial pressure is at all times higher than that in the veins, there will always remain this normal difference under all circumstances. Again, as the cerebrospinal fluid is at a pressure between that in the arteries and veins, an increase of pressure in those systems will only result in producing a corresponding rise in the cerebrospinal pressure. If anything tends to change the relation between the arterial and venous systems in the head, it would seem that inasmuch as there is a trap-like formation in the terminal sinuses and no such obstructive mechanism in the arteries, the arterial system would show a slightly relative, higher degree of pressure than the sinuses

Further, while the foregoing applies to the normal state in the hydrocephalic child the pressure in the fluid is many times higher than in the sinuses, and there can be no tendency



ticles From dog No 19, at the time of the operation (Fig 4) upon the hypophysis, the left testicle was removed, 15 days later the dog choked to death in an endeavor to swallow a whole cold boiled potato The autopsy showed that the remaining testicle had undergone a very marked atrophy, due microscopically to a complete loss of the spermatogenic cells Dog No 20, likewise an old dog, showed the same condition of striking atrophy after three weeks Dog No 21, dying on the thirteenth day from an undetermined cause, shows no clusters of young spermatozoa in Sertoli cells nor spermatozoa free in the lumen Spermatids of first and second order are present in moderate quantity The epididymis is crowded with spermatozoa Just how soon after the removal of the hypophysis this atrophy commences we are unable to state, but from the three cases cited it is evidently very early The third change which we have noted has been the increase in weight. This change in our experience does not begin until some time after the operation For example, Dog No 15 (Fig 5), operated on February 7, 1912, weighing about 17 kilos, showed no particular change until the middle of the following June, the dog then weighed 18 kilos On October 4 the dog weighed 27 kilos The same may be said of the other dogs in our series (Fig 6), so that the question has arisen in our minds whether this tendency to obesity is due to a loss of the hypophysis or to a loss of some other function of the body which is controlled by the hypophysis

The change in the pancreas has been a constant finding, the testicular atrophy apparently is quite constant Dog No 16 showed what seemed to be a decided atrophy on palpation some weeks after operation, but at autopsy 7 months after the testicles were normal, this dog showed quite a large rest of pars anterior and pars intermedia, but dog No 12 showed an equally large rest, with complete atrophy of the testicles, and dog No 22 showed no demonstrable gland substance, yet had normal testicles The increase in weight is apparently constant if the dog lives long enough Perhaps the most important question to-day in connection with the ductless glands is

those which lived for months, a block of tissue was removed which included the optic chiasm anteriorly and the corpora mammilaria posteriorly, with about 4 mm of tissue each side of the medial sagittal plane. This block was mounted in paraffin and serial sections prepared. Careful examination of this material revealed that in only two dogs, dogs Nos. 11 and 22, can it be said that there is no evidence of either pars intermedia or pars anterior. The remnant of the gland found in dog No. 12 was functionally very active, if one may judge by the extensive colloid-like formation and the same appearance of the cells of the pars intermedia which one sees in the normal gland, this dog presents complete atrophy of the testicles.

In the work reported by Aschner with young animals he notes that, in his experience, no marked changes occur after the removal of the gland from the adult dog. The dogs in our series were all full grown. We have no means of judging their exact age except by the fact that they all possessed at the time of operation a complete second set of teeth, in fact, dogs Nos. 19, 20, and 22 were noted as old, their front teeth being worn down almost to the gums.

In this series the first change to be noted was an indetermined effect upon the pancreas. At the autopsy of the dogs in the latter part of the series, that is, in those dogs in which we regularly made note of the condition of the pancreas, it is recorded that the organ presented a striking red coloration, having at autopsy the appearance of the gland seen at the height of digestion. Ordinarily at autopsy the pancreas presents the usual picture of a pale, even whitish, organ, the lobules at the edge being rather hard to differentiate from the neighboring fat tissue. In these animals the pancreas was evidently much congested and yet the microscopical study of sections of these organs did not reveal any very marked changes. The changes seen were perhaps identical with those to be found in a pancreas at the height of digestion. The second change in point of time, which we have noted, has been the atrophy of the genital apparatus, particularly of the tes-

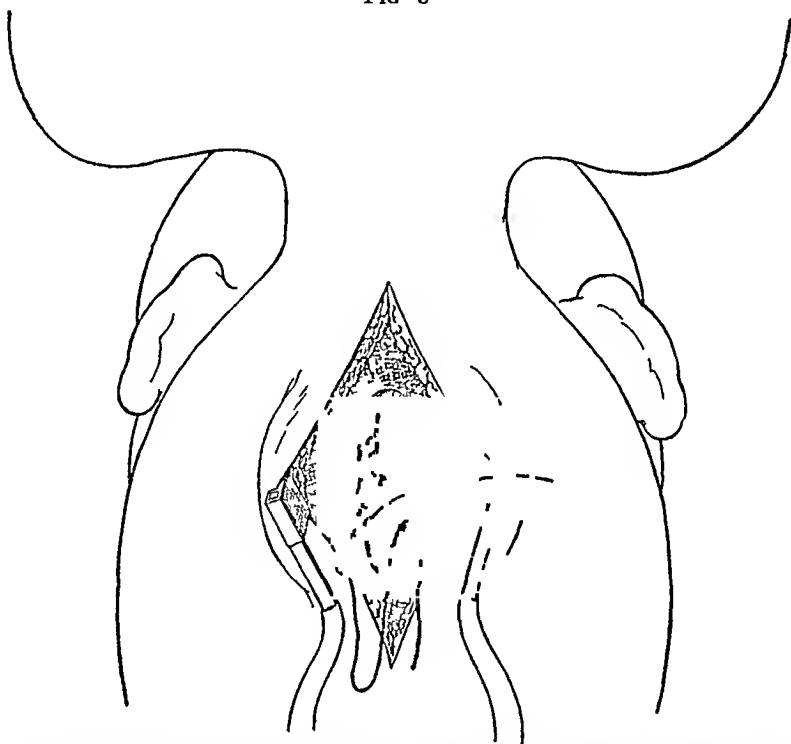
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treated by Ferguson's and Cushing's technic His first case seemed to have the disease arrested after two months His second case died after a decompression operation following the spinal drainage His third case died on the table after breaking up adhesions about the cerebellum as he was about to close up the soft parts

(d) Hydrocephalus complicated by spina bifida, the former treated through operative interference with the latter

FIG 8



The suture has been tied The design of this suture is not only to guide the tube into position but also to fasten it there, and further to hold together the two membranes the dura and arachnoid which are found at this point

Kausch<sup>2</sup> gives a summary of these cases which have been operated upon The prognosis is even worse than in hydrocephalus alone The various measures used are directed primarily to the treatment of the spina bifida

(e) Drainage of the subarachnoid space, "fourth ventricle" Ballance<sup>23</sup> in 1891 was undoubtedly the first to practise drainage of the cerebellar fossa Parkin,<sup>24</sup> Ord and Waterhouse<sup>25</sup> all performed the same operation of trephining

be no agreement as to where tuber cinereum ends and infundibulum begins. We have found no evidence whatever in our work which would incline us to agree with him in this particular.

We are presenting this paper at the present time for two reasons. First, we believe that the question of the essential or non-essential nature of the hypophysis is an important surgical matter, and from the results of our work we believe that the entire gland can be removed without danger to life. In the second place, from our work we believe that there is but one surgical indication for operating, namely, intracranial pressure. If such experimental experience is of any value when applied to clinical questions it is our further belief that the intracranial method of approach is to be preferred to any other method, and that the method of operation in human cases which has been elaborated by Frazier is undoubtedly the most correct from the point of view of anatomy and of surgical technic.



have been made, the area of brain exposed is shown in Fig. 4.

If the tumor has been located in the parietal region, a single bone flap whose anterior border is a line directly upward from the condyle will be sufficient to expose the proper brain area.

In Fig. 4 is shown the method of opening the dura where the tumor is in the central area of the brain. First, the ordinary dural flap indicated by A and A' is made. Second, if more pressure must be released, an additional straight incision is made in the dura indicated by B and B', which releases the hemisphere in a backward direction.

In Fig. 5 two small arrows indicate the direction in which the frontal lobe may be released, and in Fig. 5 is shown the exposure of the frontal lobe. The posterior border, if thought best, may be carried backward an inch, or any distance deemed advantageous. In Fig. 6 is shown the posterior releasing bone flap in operations on the temporal regions.

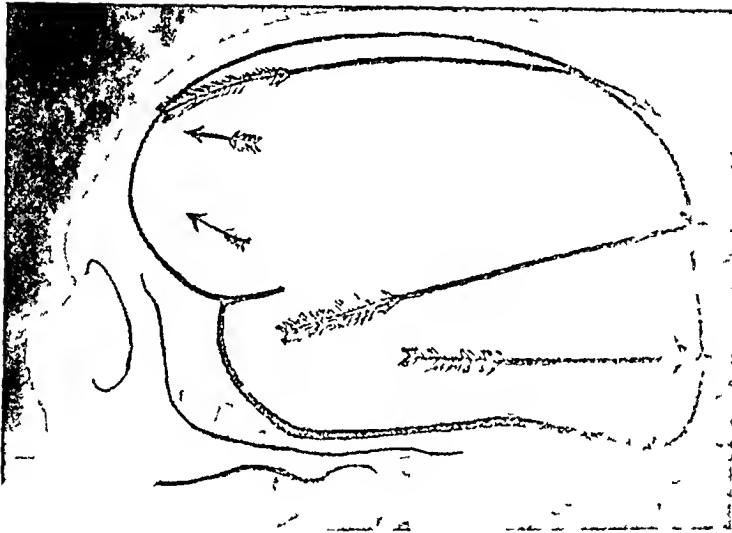
Advantages to be gained. A more accurate localization of the tumor, the operation can be carried out in a much more satisfactory manner, the tension is distributed in such way as to be greatly minimized, and in reality this tension is the most potent factor in preventing the proper surgical procedure.

#### HEMORRHAGES

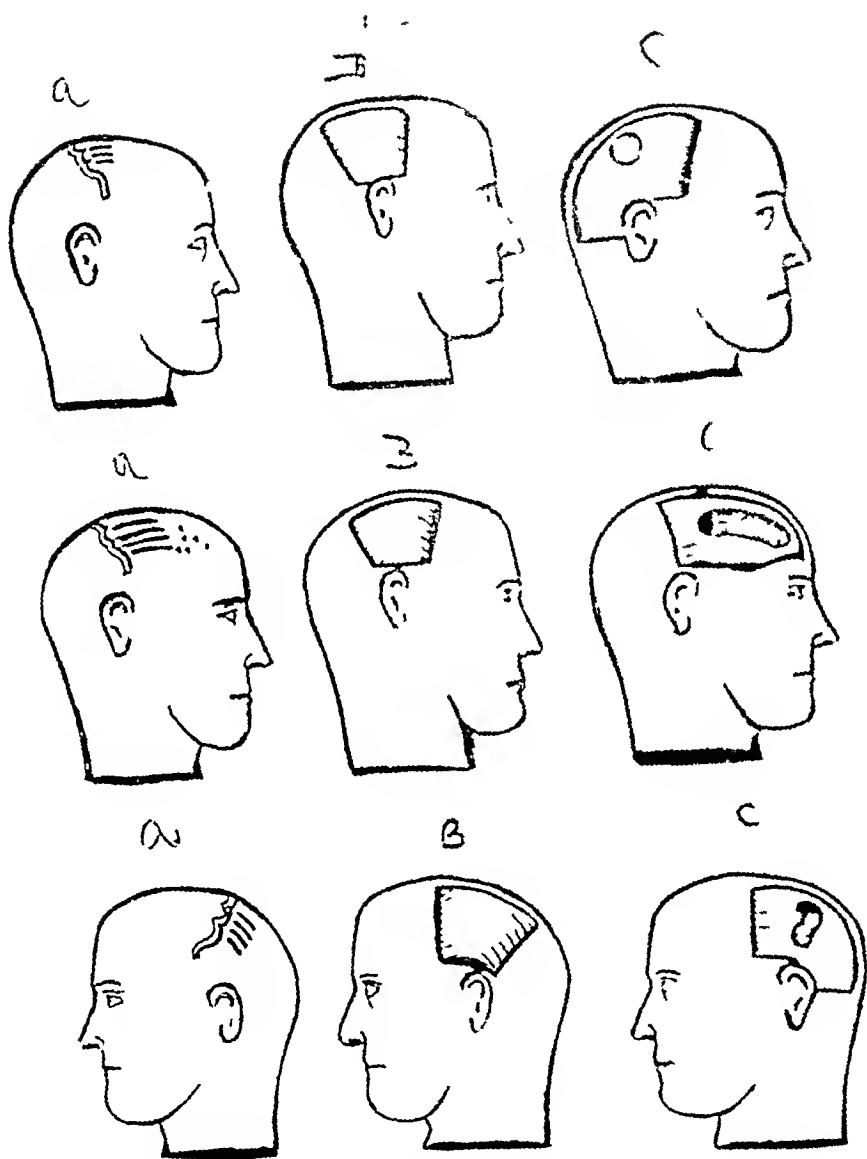
In 1911 I received a hurried call at 2 P. M. In twelve minutes the hospital was reached. The house surgeon gave me the following history as we went together to the patient's room. A man of previous good health, forty-five years old, had been in the hospital two weeks. There had been a slight paralysis of the patient's right side, which had slowly progressed during this period. On the previous day at 11 o'clock he had suddenly raised himself in bed, after which he grew worse with the usual symptoms of an intracerebral hemorrhage. He was entirely unconscious during the night, and it appeared that he would certainly die during the morning preceding the afternoon of my first visit.

I immediately ordered his head shaved and his removal to the

FIG 1



Shows by the long arrow the direction in which the pre-  
 within the cerebral hemisphere may be released by the con-  
 backward displacement of the hemisphere. The short arrows  
 show the direction of displacement of the frontal lobe when only the  
 frontal lobe is to be exposed.

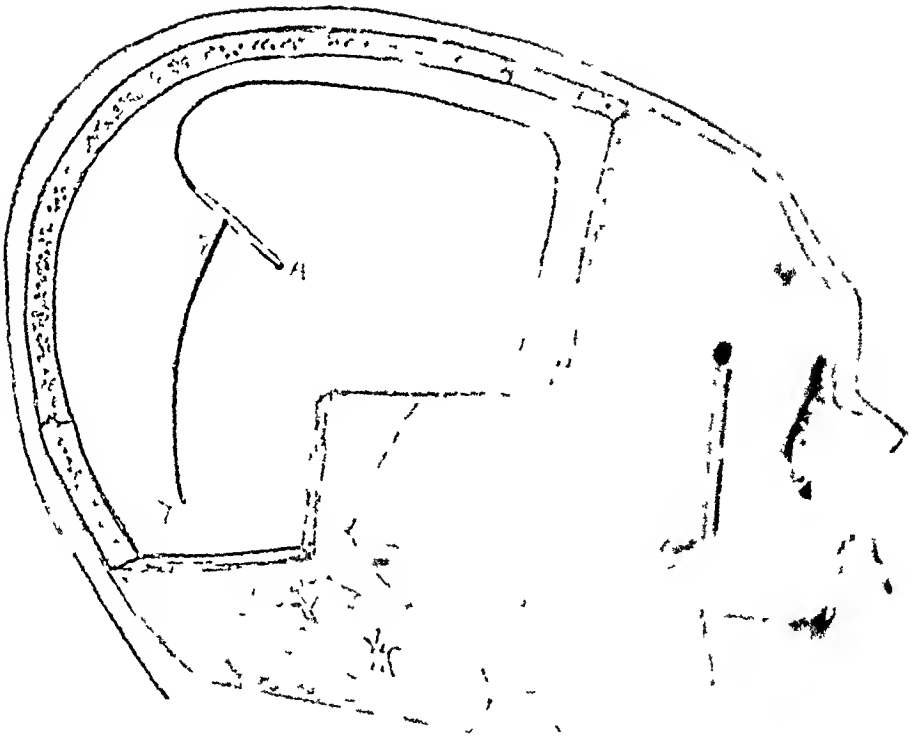


Represents the localization of intracerebral tumors by pupation of the eye and has been relieved

FIG 3

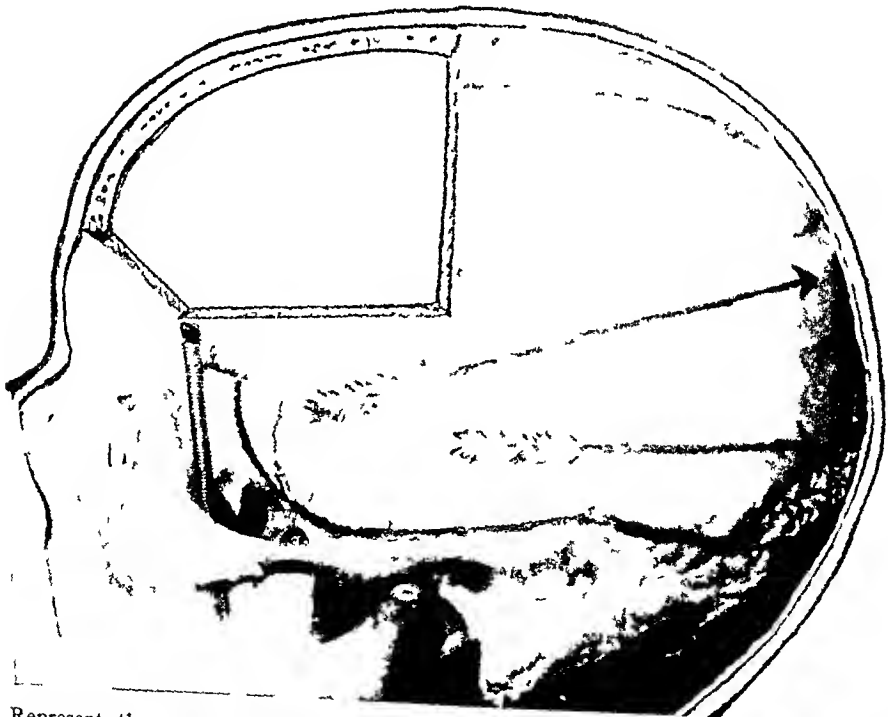


Represents the exposure of the hemisphere by two bone flaps. When the exposure of the motor region shows the tumor to be deeply located. The second posterior bone flap is made to release the tension in the hemisphere. The expanding wire sutures are also shown looped down. When possible to knot beforehand only, one bone flap should be made.

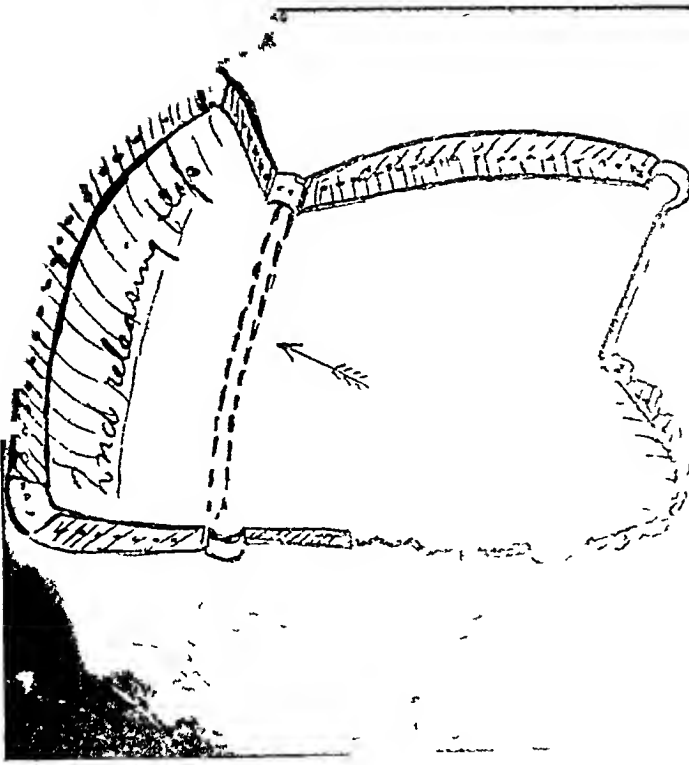


Shows the incisions in the dura mater by two bone flaps. The first dural flap may be used in the up and down direction. This area of brain may be exposed by the second flap.

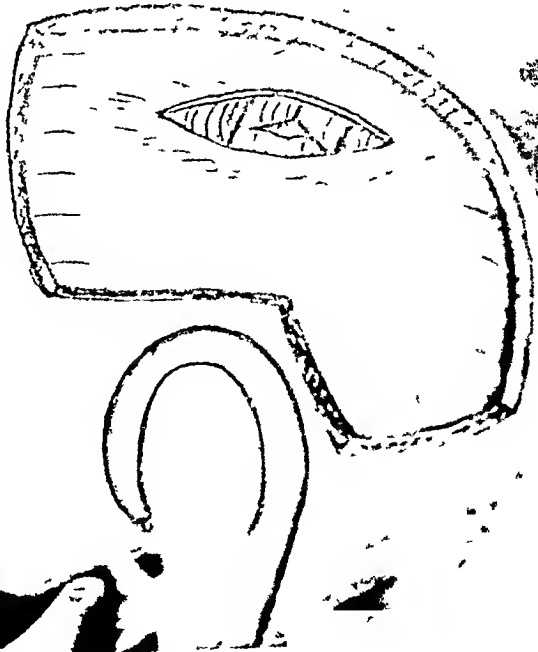
Fig. 2



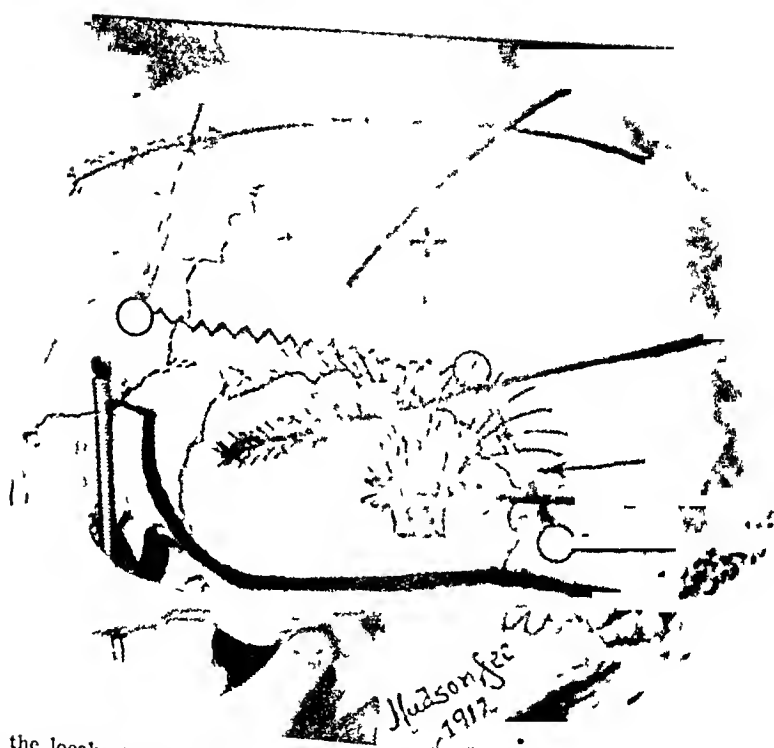
~ Represents the exposure of the frontal lobe in such a way as to release intracerebral pressure. Bone flap may extend further in a posterior and downward direction if necessary.



Shows the exposure of the posterior bone flap. The bone phine openings are made just behind the ear. The fibres of the flap and the bone cut at the base of the flap will take place. The bone flap may be cut away and may be extended to a point near the ear.



Area of Brain exposed in one or for



A study for the localization of the points to be observed in operation for intracerebral hemorrhages and the outlines of the bone flap in exposing the brain. The sheaf-like part to the channel cut in the bone beneath the temporal muscle and scalp. The solid line in front of the extreme anterior border of such a flap. The broken line running parallel with the coronal suture indicates the position behind which it is not safe to make the anterior border of the flap. The large cross directly above the external opening of the ear and within the insertion of the temporal muscle is the point for puncturing the brain in search for the large majority of intracerebral hemorrhages. The sheaf-like markings represent the internal capsule.





FIG 10



Author's arrangement for tunneling via a 1/2 inch diameter pipe

about three-quarters of an inch long are made at suitable points with the finest Gigli wire saw. The rest of the flap is made by cutting a channel about one-eighth of an inch wide around the bone flap. To properly control the bleeding in the bone it is necessary that this channel be at least one-eighth of an inch wide to allow the proper insertion of bone wax should bleeding occur. Where the bone is cut with a saw, bleeding is very common. Where it is cut with forceps, I have never seen a profuse hemorrhage, as the diploe of the bone is tightly closed by the crushing action of the forceps. In one case of my own a large venous sinus one inch in length was entirely closed so that not a drop of blood escaped. This was discovered by a later removal of a small strip of bone. After the bone flap has been outlined it is carefully tried with the lever ends of the dural separators. If the base does not readily break it is weakened by cutting under the temporal muscle and scalp, or scalp on both sides, until the breaking is easily accomplished. There may be many points of troublesome bleeding on the surface of the dura. These are best stopped by cutting small pieces of the temporal muscles and sticking them over the bleeding points until they adhere.

In opening the dura for tumors, various incisions may be demanded which are explained in the pictures. In opening the dura for intracerebral hemorrhage, great care should be used, the cortex carefully protected, the brain not being allowed to escape from the dura, if it is possible to prevent it.

In a case in which an apoplectic clot has been evacuated, the dura should be carefully closed if possible, but in all cases drain. It is best to drain the cavity in the brain with a soft strip of rubber tissue, but the tissue should not extend to the bleeding vessel. A small trephine opening may be made in the bone flap for the drainage. At the most suitable angle of the dural opening a piece of rubber is stitched for subdural drainage. Later these drainage points are repaired, if necessary.

In the case of unremovable tumors, the bone flap is fixed down with the expanding wire suture, the same method to be

It is believed that it is necessary that the brain should be invariably exposed over a large area, and in such a manner as to permit of the consecutive displacement of the entire hemisphere, and that only one bone flap should be made, the anterior border of which should generally be represented by a line running straight upward from a point just in front of the condyle of the lower jaw.

According to pathologists fully 50 per cent of intracerebral hemorrhages involve the internal capsule, therefore a point about two inches above the external opening of the ear, and posterior to the fissure of Rolando, should be selected for puncturing the brain in the search for the hemorrhage. No opening in the dura, however, should be made until all aid possible has been gotten by palpating the exposed area of brain with the dura intact. Should any portion of brain be found more protuberant or denser than any other, this, perhaps, should be the point of puncture.

*Operative Technique*—It is necessary, where the exposure of the brain is made in such way as to allow the displacement of the hemisphere, to make several openings in the skull and to cut long channels. This work must be done quickly and easily, and in such manner that the patient receives the smallest possible amount of shock and jar. And it is also necessary that the surgeon's fingers and hands are not fatigued, or his sense of touch interfered with. This requires an entirely new surgical armamentarium, represented by self-stopping trephines and powerful two-hand channel-cutting forceps, and many other new instruments for cranial surgery.

In making the large bone flap, as shown in Fig 7, the preservation of the scalp must be considered, and the solid line in Fig 8, indicated by the small arrow, is cut under the temporal muscle and scalp.

First the head is shaved and disinfected after some reliable process, the writer preferring the final corrosive sublimate alcohol application, being very careful that none of this solution is gotten into the patient's eyes. Several primary openings are made outlining the bone flap, two short bevels

These trephining burrs, to the untaught, *superficially* resemble burrs that have been in use many years. They differ from the ancient trephining burrs in possessing a new quality by which they stop automatically just where they should stop when the holes are being made through the bone. They are the result of the writer's discovery of a new mechanical principle, and the first *really new* trephining instruments that he knows of.

In cutting narrow channels in the skull, saws, whether straight or circular, hand- or power-driven, are not permissible. They open up the blood channels in the bone, making it very difficult to control the bleeding from the bone, besides, it is impossible to cut down upon the dura safely with the saw. The proper method of making narrow channels in the skull is with powerful crushing forceps, cutting from within outward. The portion of the skull that may bleed when cut is the part which contains the diploe. When this portion of the skull is cut with crushing forceps, the internal plate of the bone is broken through and pushed against the external plate, by this act the blood-vessels are closed, and in addition to the blood-vessels being closed the semifluid elements in the portion of bone and diploe which has been broken through are forced into the surrounding bone, acting as a bone wax, effectually stopping the hemorrhage.

Fig 6 shows a powerful two-hand channel-cutting forceps, cutting out a channel in the bone three-sixteenths of an inch wide, and cutting each inch of channel in five strokes. These forceps are necessary where the brain may be left decompressed. The width of channel made by these forceps is the proper one for such an operation.

Fig 7 is a one-hand form of these forceps cutting a channel  $\frac{3}{32}$  of an inch wide, and should be used where a simple osteoplastic flap is made. These forceps should not be confused with the forceps of the Dahlgren type, as they act upon a different mechanical principle and are very much more effectual.

Fig 8 shows a channel-cutting forceps cutting upon cir-

applied where the operation failed to find and remove the blood clot

It is my practice in many cases to fix the bone flap back with silver wire sutures. To do this it is necessary to make small drill holes in both sides of the bone. This is best done by grasping the bone with a drill guide as shown in Fig. 9.

The best method of closing the dura is with fine curved needles and fine silk applied as interrupted sutures; but in these cases as time is important the fine silk is applied in continuous suture the silk having been sterilized in vasoline. When the scalp flap is made two hooks are made in the free border on both sides so that the flap may be accurately adjusted in closing. The closure must also be quickly done and two long needles are used. Fine silk is the suture material used. The two needles are inserted together about three-sixteenths of an inch apart. They go entirely through the thickness of the scalp. No. 1 is first tied while No. 2 remains in the scalp. No. 1 is then advanced beyond No. 2 and inserted through the scalp again. No. 2 is pulled through and the silk thread tied. This is repeated until the entire scalp wound is closed.

This method prevents the inversion of the edges of the scalp and allows the taking of the entire thickness of the scalp within the grasp of each ligature, so that no blood-vessels in the entire incised scalp require tying. The method is very quick and satisfactory.

The methods and details have been accurately pictured and described. The method in its entirety must be followed until better methods have been developed, if the best results are to be obtained.

#### DESCRIPTIVE LEGENDS OF ARMAMENTARIUM

Figs from 1 to 4, inclusive, are the self-stopping burrs

Fig 5 is a hand brace for driving these burrs

The writer frequently makes from six to ten primary openings in the skull, these openings serving as safety stations, and to expedite the cutting of the channels in the bone which outline the large bone flaps



presupposes that the communication between the cranial and spinal subarachnoid (subdural) spaces is free. If there is a block at any point in the intracranial passages, at the foramen of Magendie, at the foramen magnum, or in the spinal canal itself, a spinal operation is futile for therapeutic purposes and also may be fatal from "corking up of the foramen magnum by the brain stem."

As to the spinal operations themselves, this may be said that they are limited in their application, that continuous drainage to the surface is contraindicated, because death will occur early from too rapid loss of fluid or a little later from infection, that regarding lumbar puncture, with the single exceptions of Bókay, it is universally admitted to be only a palliative measure and has given no permanent curative results.

Regarding drainage into the subcutaneous, subfascial, or submuscular tissue, it is found that, while the tissue may for a short time absorb a considerable amount of fluid and the duration of this action may be prolonged by massage and efforts at increasing the hyperæmia of the parts, still in a comparatively short time the space becomes the seat of plastic lymph exudate, the avenues of escape are closed, the absorption of fluid ceases, and a cyst is formed. This method of drainage, therefore, soon becomes inoperable.

We have left, then, only the spinal peritoneal method of Ferguson and Cushing. Their plan of treatment is clearly limited to a very few cases. Requiring a laparotomy and a laminectomy as preliminary to the actual drainage technic, it is a procedure of great severity that can be borne only by a comparatively strong child, but these sufferers from hydrocephalus are not sturdy—far from it, and if there is an easier way to secure the desired result it should be used. Aside from the technical drawbacks, this plan does not yield any better results than many others. The child dies from sudden evacuation of the fluid or from a return of the original condition due to closure of the drainage tract.

The indirect method of ligation of the carotids advocated

# COEXISTING INFECTION AND SARCOMA OF THE THYROID.<sup>1</sup>

BY MILES F PORTER, M D.,  
OF FORT WAYNE, INDIANA

Surgeon to the Hope Hospital, Professor of Surgery in the Indiana University School of Medicine

SARCOMA of the thyroid is a rare disease, and sarcoma of the thyroid complicated by infection still more rare

Muller and Speese<sup>1</sup> found only 11 cases of sarcoma recorded in the literature of this country prior to June, 1906 Only 11 per cent of these cases occurred in patients under thirty In 53 per cent of malignant disease of the thyroid, sarcoma and carcinoma, they found a previous history of goitre, and in more than half the cases this history extended over a period of more than ten years Two-thirds of the cases were in women and 53 per cent of the cases occurred between the ages of forty and sixty. They found adenocarcinoma and round- and spindle-cell sarcoma the most frequent types Metastasis involves the lungs and bones most commonly and of the latter especially the skull and inferior maxilla

They report that carcinoma of the thyroid invades distant parts by way of the blood-vessels, and sarcoma through the lymphatics with greater frequency than is the general rule Malignant goitre caused death in 70 per cent of the cases reported by them I have made quite an extended but not exhaustive search of the literature, but have succeeded in finding only four cases beside my own of sarcoma of the thyroid reported since 1906

E A VANDERVEER,<sup>2</sup> of Albany, reported a case of sarcoma of the thyroid in 1907 occurring in a male aged 70 He gave a history of

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\* Read before the Western Surgical Association, December, 1912

<sup>1</sup> Univ of Penn Med Bulletin, Philadelphia, June, 1906, Abs Jour A M A, vol xlvii, 1906, p 72

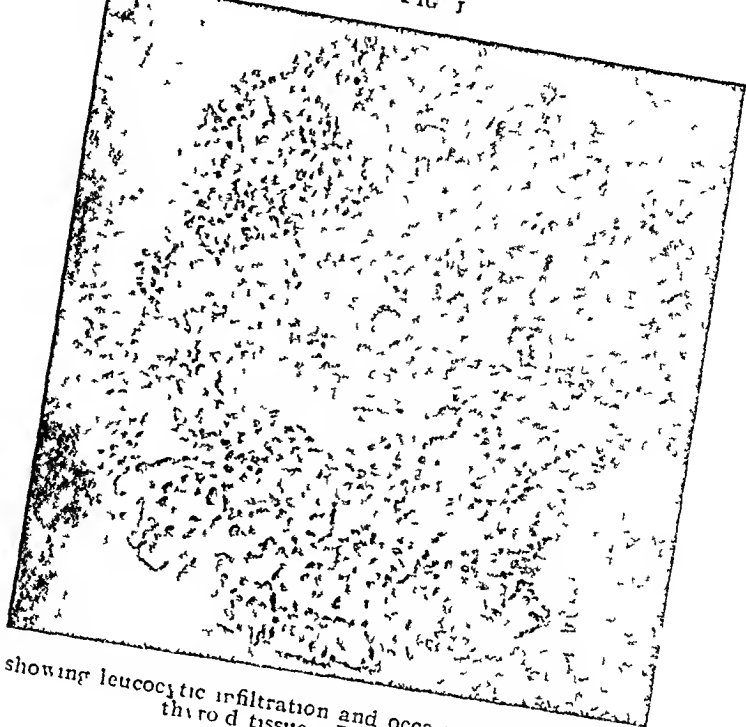
<sup>2</sup> ANNALS OF SURGERY, vol xlii, p 829, 1907



the matter of their interaction, are we to consider the hypophysis, for instance, as a link in a chain, which link, if broken, breaks the chain, or as members of a family, where if one member drops out, he can never be replaced, but the other members of his family can take up his work to a greater or less extent?

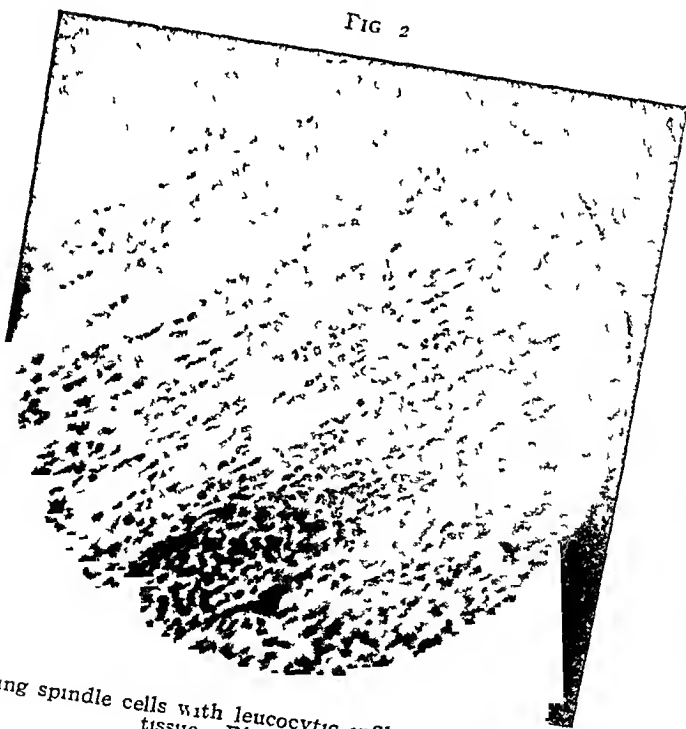
In three of the dogs which we have autopsied after several months' time, the thyroid presented a change, the significance of which is hard to interpret. There is an evident increase in the amount of colloid with a flattening of the cells of the alveoli. In summing up our experience with these 22 cases, it is evident that the hypophysis is not essential to life, there are undoubtedly three well-marked changes which follow hypophysectomy, the first change concerns the pancreas. We have not worked very extensively with the question of sugar tolerance and therefore have nothing to say. It is evident that such a study can only be made by determining the individual sugar tolerance before operation and obtaining an index by this means as to the normal carbohydrate tolerance of the individual animal. The second change is the atrophy of the testicles, which is of very early appearance, being extremely marked by the end of the second week after operation. Whether or not this atrophy can be compensated for by the function of some part left behind or of some glandular rests which have been described by Cushing in the floor of the sella turcica, we cannot say. Increase in weight is of late appearance, and whether it be due to the loss of the hypophysis primarily or due to the secondary atrophy of the testicle is not at all clear in our minds.

Our results agree with the most recent work on the subject reported by Aschner, except perhaps in two particulars. He worked almost exclusively with young animals, and inclines to the belief that the removal of the hypophysis from the adult dog is without effect. In the second place he ascribes the atrophy of the testicles to injury of the tuber cinereum. This point of view seems to us a purely academic one. There can



Author's case showing leucocytic infiltration and occasional giant cell Note absence of thyroid tissue Rhamy 1 obj

FIG 2



Author's case showing spindle cells with leucocytic infiltration Note absence of gland tissue Rhamy 1 obj



My own case is as follows

S. B., male, aged 12, admitted to Hope Hospital, Sept. 5, 1912. Family history good. Never been ill until present trouble came on ten weeks ago. At this time he noticed a small lump on the front of the neck just above the end of the sternum. This has been growing, and there also appeared lately a small lump above and to the left of the original.

Examination showed a well-nourished blond lad with a goitre the size of a lemon which seemed to involve equally all parts of the gland. The skin was not discolored nor attached to the goitre, which was very firm, not nodular, slightly tender, and not painful. Above and to the left of the goitre there was a somewhat tender lymph-gland as large as the end of my thumb. This gland was freely movable. Urine was negative. The blood showed 20,200 white cells, with 74 per cent polynuclears. The temperature ranged from normal to  $100.6^{\circ}$  F. There were no symptoms of hyperthyroidism. At times there was some choking sensation. Slight headache. Appetite poor. Bowels regular. It was thought that the trouble might be entirely inflammatory, although the probability of malignancy was recognized. Operation was advised and accepted.

On Sept. 10, five days after admission, the usual collar incision was made under ether. It was found impossible to separate the muscles and fascia from the surface of the goitre, save by cutting, on account of the dense adhesions. The gland structure was yellowish gray in color, not vascular, firm, and somewhat friable. That portion of the gland immediately overlying the trachea was removed, a drain inserted and the skin wound closed up to the drain. The wound healed promptly and the boy left the hospital 16 days after the operation.

Dr. Rhamy's report is as follows:

"After a careful study of the sections from the thyroid of L. B., I find that beneath the very marked inflammatory infiltration there is undoubtedly a spindle-cell sarcoma. This shows plainly in areas where there is little leucocytic infiltration. In the greater part of the growth, however, the leucocytic infiltration is so intense that the sarcomatous growth can only be made out in the light of the other fields which do show it plainly. Nowhere in the growth can I find any recognizable thyroid structure" (Figs. 1 and 2). It is important to say here that the report on the frozen section made at time of operation was that the trouble was inflammatory.

He also states in a subsequent communication that both culture, and smears demonstrated a staphylococcus infection. The report from the Columbus Laboratory is as follows:

"Specimen is made up of embryonal connective tissue that shows little or no tendency to form adult connective tissue. There are a few foci of necrosis. It is a small round-celled sarcoma."

I tried to get a late report from the patient but failed, so I cannot say whether he is still alive or not.

According to Muller and Speese round- and spindle-cell are the most frequent types of sarcoma found in the thyroid. Of the cases collected for this paper there are two in which the type is noted, one fibrosarcoma and one large round-cell sarcoma. In my own case the two pathologists who examined the specimen differed somewhat, the one pronouncing it to be a small round-cell sarcoma and the other classifying it as belonging to the spindle-cell variety. According to Kocher the spindle-cell type is the most common and the large round-cell comes next, while the small round-cell variety, he says, is rare. Spindle-cell sarcomata may be converted into bone or cartilage. The case of Chavanez and Pierie Nadal reported above illustrates this. This author (Kocher) also says the round-cell variety often resembles lymphosarcoma so closely as to make the differentiation difficult. It will be remembered that Warthin in his report on Snyder's case, as noted above, suggests that that may be a lymphosarcoma of the large round-celled type. The complete destruction of the gland tissue by the neoplasm is quite common. It will be remembered in my case Dr. Rhamy was unable to find "recognizable thyroid structure."

The bones are frequent seats of metastatic growths originating from malignant disease of the thyroid. Especially are sternum, ribs and scapulæ apt to be attacked in this way.

"coma of the thyroid"

Invasion of distant structures by way of the lymphatics. A sarcoma originating in the thyroid seems much more common than is the usual rule concerning metastasis in sar-

coma Had I been better acquainted with this fact I would not have allowed the lymphatic involvement in my case to weigh so heavily as I did in favor of a diagnosis of thyroiditis Concerning the combination of infection with sarcoma in the thyroid, I could find no case reported In view of the frequency of infection in malignant growths generally, however, it is fair to presume that the combination is not rare.

There is very little to say concerning the diagnosis of malignant thyroid disease, but it is important, perhaps, to emphasize two or three points

First, I have a feeling that with malignancy in enlarged thyroids as with malignancy in large prostates the condition is more frequent than it is generally thought to be This feeling is a result of the systematic and careful examination of all goitres removed by me for the last year or more As yet I am not able to report in detail

Second, comparatively sudden and rapid increase in size in an old goitre should arouse suspicion of malignancy, especially if this rapid growth is accompanied by pain

Third, hemorrhage into an old goitre should raise the question of malignancy

# EXPERIMENTAL DEVASCULARIZATION OF INTESTINE WITH AND WITHOUT MECHANICAL OBSTRUCTION

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AND

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EXPERIMENTAL work on intestinal obstruction has been quite abundant in recent years, yet the subject is at present by no means settled. Much, however, has been learned. The work of Stone, Bernheim and Whipple (*Johns Hopkins Hospital Bulletin*, June, 1912) shows that the theory holding death from obstruction to be due to a toxic product formed in the mucosa is correct. By a series of brilliant experiments they have isolated the toxic principle from the mucosa of the obstructed intestinal loop. They have freed it from germs by the centrifuge and compared it with preparations from the mucosa of a normal intestine. They have checked up their experiments by controls which have been so frequently lacking in other work of this character and have demonstrated that this toxic product is constant in an obstructed loop of bowel when ileus occurs, that it is not due to germs, that it is not found in the mucosa of unobstructed bowel, that it decreases in quantity or virulence from the duodenum to the ileum, that the injection of this material into an animal will cause symptoms of ileus, and, finally, that animals may be rendered partly immune to obstruction by injection of graduated doses.

Just why this toxic product forms in an obstructed loop has not been ascertained. The action of bacteria and the interference with circulation do not seem to have a consistent relation in causing it. It has long been known that the lumen

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\* Read before the Southern Surgical and Gynecological Association, December 19, 1912

of the bowel itself might be occluded without producing symptoms of ileus, provided the obstruction was low down in the intestine and the animal was not fed or purged. Hartwell and Hoguet (*Journal A M A*, July 13, 1912) have noted that obstructions high up are not so rapidly fatal if the animal is given salt solution underneath the skin and infer that the early death of a high obstruction is chiefly due to the marked loss of water. This does not entirely agree with the work of Stone and his colleagues, who find that the toxic principle is more potent in the duodenum than when a loop of bowel is obstructed further down.

Our experiments were originally undertaken for the purpose of demonstrating, if possible, the difference in the effect on an animal when the devascularized segments of intestine were obstructed at both ends and when such segments were open and their products allowed to flow freely into normal bowel; but the fate of the obstructed loop eventually became the chief subject of investigation. In all experiments the last portion of the ileum was used. All the animals were dogs, and in each instance they were operated upon under full ether anæsthesia and every precaution taken to prevent pain. There were twelve experiments. Two recent experiments, together with ten that have been previously reported (*Journal A M A*, August 24, 1912), may be summarized as follows.

In each experiment a segment of bowel in the lower ileum was devascularized by cutting the mesentery close to the border of the intestine and ligating the blood-vessels. In five of these experiments tapes were tied at each end of the devascularized segment to obstruct, but not injure, the bowel, and so shut off its lumen from the healthy intestine. In all except the first (dog No. 1) the omentum was wrapped around the intestine. Of the five operations in which tapes were placed on the devascularized segment, two dogs died within 48 hours after the operation from gangrene and perforation of the obstructed segment with peritonitis. One died after three days and two others lived 13 and 14 days, respectively. (See table.) Of the seven dogs in which the mesentery was sep-



arated and the devascularized segment left unobstructed, one died 27 days after the operation from mechanical obstruction from adhesions, another died 28 days after operation from causes not attributable to the operation, and the other five were killed under anaesthesia at periods varying from 15 to 49 days and were apparently healthy at the time of their death. The dog allowed to live longest (No. 12) was in excellent condition when killed 49 days after operation. The specimen showed the bowel well nourished, unobstructed, and apparently normal.

These experiments seem to show that the toxic product is either not formed to any marked degree when a loop of the ileum is completely devascularized, or else if it is formed, the normal mucous membrane does not absorb it. Stone states that it is of low potency in the ileum. According to the experiments of Murphy and Vincent (*Boston M. and S. J.*, November 2, 1911), venous obstruction always adds to the gravity of the situation. We have not attempted anything along this line, but in the seven dogs in which the loop of intestine was completely devascularized without obstruction of the lumen, there was no death that could be attributed directly to the devascularized loop and only two deaths occurred at all—one 27 days after the operation and the other 28 days after operation. Of five dogs in which the loop was both devascularized and obstructed, death in two was due to rupture of the gangrenous segment and general peritonitis, and of the remaining three, one died after three days without rupture of the segment and the other two lived 13 and 14 days, respectively. The death that occurred at three days might possibly have been due to the toxic principle worked out by Stone, but the other two dogs apparently died largely from starvation. Of the seven dogs with devascularized segments without obstruction, it is interesting to note that whatever product was formed in these segments did not apparently influence the health of the dogs, though it could flow freely to the healthy bowel. The most interesting feature, however, is the fact that the bowel in each instance survived and functionated satisfactorily. The technic merely consisted in com-

pletely severing the mesentery close to the bowel, wrapping the omentum around the segment and fastening it with a few stitches

It has usually been taught that if a bowel is deprived of its nutrition from the mesentery for even a short distance, a resection should be done. These experiments demonstrate that, in the dog at least, a loop of four or five inches of intestine may be deprived of its blood supply through the mesentery and may still survive if omentum is wrapped around it and fastened in position. In long abdominal operations where for some reason the mesentery has been severed from the bowel and the patient's condition does not admit of a resection, it appears justifiable to wrap the omentum around this portion of the bowel and stitch it to itself and the intestine, with a reasonable expectation that the segment will be properly nourished through the omentum.

TABLE 1.—SEPARATION OF MESENTERY WITH TAPES ON DEVASCULARIZED INTESTINE

No of Dog	Number of Inches of Intestine Devascularized, and Operative Notes	Post-operative Notes	Length of Life after Operation	Post-mortem Notes
1	Eight inches. No omentum wrapped around devascularized segment	Dog looked sick twenty-four hours after operation, abdomen distended, respiration rapid	Died after 36 hours	Large amount of bloody fluid, bowel proximal to tapes greatly distended, omentum adherent to abd incision but not to intestine, segment of bowel black, jelly-like, with large perforation near proximal tape
2	Two inches. Omentum wrapped around segment of bowel and fastened with silk sutures	Dog apparently well for four days, for three days quite sick, then better for three days, when he became worse	Died after 14 days	No free fluid but coating of lymph on peritoneum, bowel proximal to tape greatly distended, distal firmly contracted, segment surrounded by densely adherent omentum
4	Two inches. Operation same as in Dog 2	Dog appeared very sick from time of operation	Died after 48 hours	Large amount of free bloody fluid, marked distention of proximal bowel, contraction of distal, omentum adherent to abd wall but not to bowel, segment black, jelly-like, large perforation
5	Two inches. Operation same as in Dog 2	Dog did well for three days, then appeared very sick for one day, again seemed better until two days before death	Died after 13 days	No free fluid, no distention of intestine either above or below tapes, omentum firmly adherent to segment, which showed but little change. The coats of this segment are somewhat discolored and swollen but sharply outlined. Evidently the omentum has preserved the nutrition of the devascularized intestine
8	Two inches. Operation same as in Dog 2	Dog appeared quite sick from time of operation	Died after 3 days	Small amount free bloody fluid, proximal bowel distended, omentum adherent to segment of bowel, which was dark, reddish and thickened

applied where the operation failed to find and remove the blood clot

It is my practice in many cases to fix the bone flap back with silver wire sutures. To do this it is necessary to make small drill holes in both sides of the bone. This is best done by grasping the bone with a drill guide as shown in Fig 9

The best method of closing the dura is with fine curved needles and fine silk applied as interrupted sutures, but in these cases as time is important the fine silk is applied in continuous suture, the silk having been sterilized in vaseline. When the scalp flap is made two nicks are made in the free border on both sides so that the flap may be accurately adjusted in closing. The closure must also be quickly done and two long needles are used. Fine silk is the suture material used. The two needles are inserted together about three-sixteenths of an inch apart. They go entirely through the thickness of the scalp. No 1 is first tied while No 2 remains in the scalp. No 1 is then advanced beyond No 2 and inserted through the scalp again. No 2 is pulled through and the silk thread tied. This is repeated until the entire scalp wound is closed.

This method prevents the inversion of the edges of the scalp and allows the taking of the entire thickness of the scalp within the grasp of each ligature, so that no blood-vessels in the entire incised scalp require tying. The method is very quick and satisfactory.

The methods and details have been accurately pictured and described. The method in its entirety must be followed until better methods have been developed, if the best results are to be obtained.

#### DESCRIPTIVE LEGENDS OF ARMAMENTARIUM

Figs from 1 to 4, inclusive, are the self-stopping burrs

Fig 5 is a hand brace for driving these burrs

The writer frequently makes from six to ten primary openings in the skull, these openings serving as safety stations, and to expedite the cutting of the channels in the bone which outline the large bone flaps

# THE SURGERY OF THE SINGLE AND HORSESHOE KIDNEY.<sup>2</sup>

BY CHARLES H MAYO, M D,  
OF ROCHESTER, MINN. SOTA

THE fact that developmental abnormalities of the genito-urinary system are the most frequent of any part of the body is not generally appreciated. Those involving irregularities of the circulation of the kidney are the most common of this group.

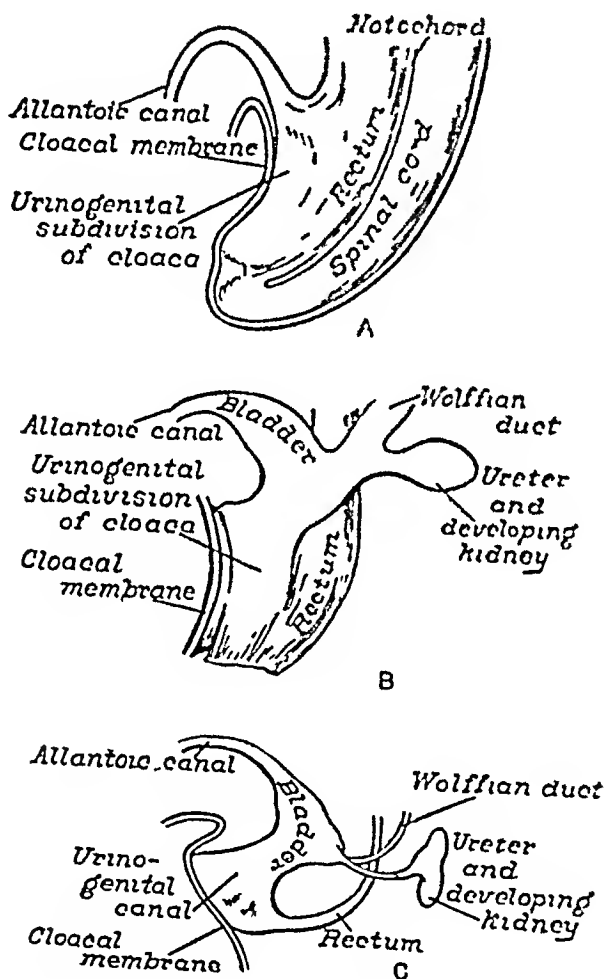
It is necessary for the surgeon of to-day to understand thoroughly these anomalies and he is also much concerned over the functional activity of the kidney, not alone because of operations upon the organ itself, but also because of its great bearing upon all surgical operations.

A brief study of the early development of the genito-urinary system during the first few weeks of intra-uterine life simplifies our understanding of the common and curious derangements of the anatomy of this tract. Early in the life of the embryo the cloaca represents both the future rectum and the bladder. It gradually becomes divided by a vertical fold into two compartments, an anterior with which the allantois and the primitive excretory ducts are connected and a posterior which becomes the lower end of the rectum. Entering the cloaca from the dorsal side are the two Wolffian ducts which furnish the parent structures of the renal pelvis and ureters. The Wolffian duct, while developed originally as a part of the pronephros—the forward nephritic organ which is exceedingly rudimentary in the human embryo—is throughout the greater part of its embryonic existence the excretory duct of the Wolffian body or mesonephros. From these two primitive structures is developed most of the genito-urinary system. The beginning of the permanent kidney—the metanephros—appears in the human embryo at from 6 to 7 mm.

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length as a tubular diverticulum formed on the dorsal side of the Wolffian duct near the cloaca. This diverticulum is surrounded from the first by a large group of cells (the renal blastema) which are of mesothelial origin which later form all the secreting portions of the kidney. The tubular portion

FIG 1



From model by Professor Keibel ("Cunningham's Anatomy")

of the diverticulum from the Wolffian duct becomes the ureter, while the distal extremity bifurcates into an upper and lower portion to form the pelvis, or collecting part of the kidney. As the bladder increases in size the single opening of the meso- and metanephros becomes a double one, consisting of the ejaculatory duct at the base of the bladder in the male and the ureter posterior to this (Figs 1 and 2)

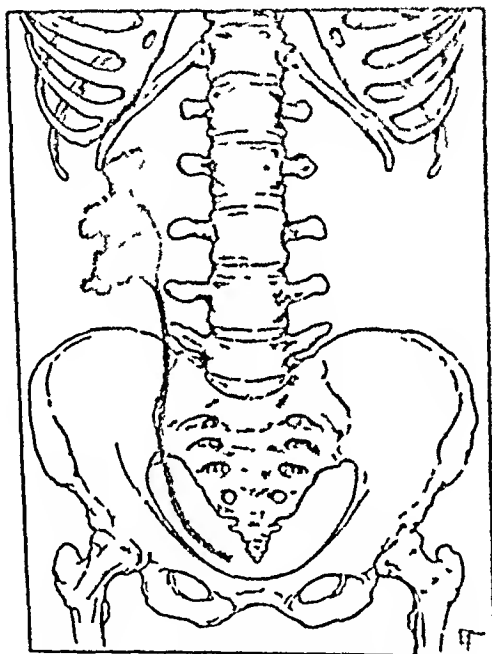
then been unexpectedly cut, with a resulting hemorrhage very difficult of control

The first point which we sought to determine is whether the entire gland can be removed by this or any other method. Two points must here be recognized. Are we justified in speaking of a complete physiological extirpation when either macroscopically or microscopically some portion of the gland can be recognized after the operation? The anatomy of the gland in the dog is such that it is probably impossible to completely remove all the cells of the *pars intermedia*. These cells extend for a considerable distance forward toward the chiasm and backward toward the corpora mammillaria. Such a condition makes total removal from a microscopical point of view impossible, but can the gland be physiologically removed? The point is perhaps well illustrated by the history of the work upon the relation of the complete removal of the pancreas to diabetes. It is doubtless impossible to remove completely every cell of the pancreas, and because of this fact the relation of the pancreas to diabetes was for a time in dispute, the explanation being offered that the diabetes was due to the nervous shock incident to the operation. Nevertheless there can be no doubt to-day that enough of the pancreas can be removed to ensure physiological results. It is the same with the parathyroids and with the thyroid, so that a limit of safety has been established by surgeons beyond which it is not safe to remove thyroid tissue. We believe that it is possible to remove the hypophysis physiologically, that is, to remove enough so that certain characteristic changes will follow. Dog No. 1 (Figs. 2 and 3) lived for 38 days, showing no peculiar symptoms until shortly before death, when symptoms of meningeal irritation developed. The autopsy showed an extensive area of softening in the infundibular region, which, as shown in the accompanying plates, must certainly have removed all hypophyseal tissue. Concerning the extent of removal of the hypophysis we have taken the following means of ascertaining whether we have been successful in completely removing it. At the autopsy of several animals which died early, and of all

each lateral mass, and 4 cases with a single trunk to the isthmus with one branch to either lateral mass. In such cases the accidental destruction of the blood supply of the entire kidney may easily occur during an operation on it.

There is nothing between the two renal mesenchymal structures during the early development of the kidneys but the forming aorta. Sometimes indeed they are in contact or even fused in front of or posterior to this vessel. This condition persisting, occasions some of the various anomalies

FIG 3



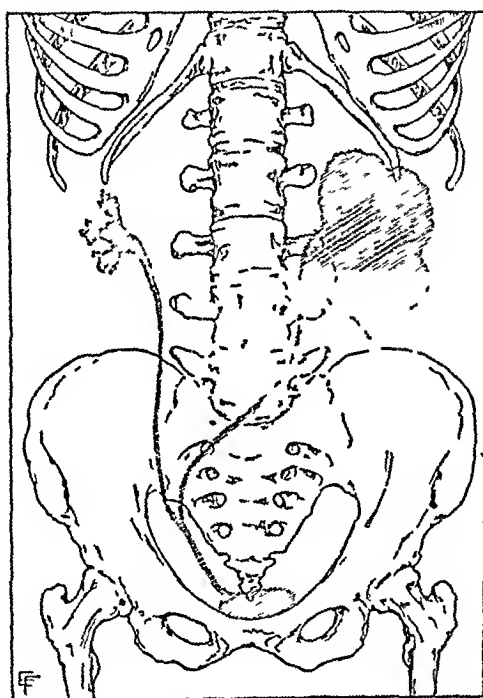
Case No 5244 —Congenital single kidney

under discussion. Rarely the secreting substance may become associated with but one collecting portion and ureter and thus there may be but one kidney developed.

We may see the possible development of congenital cystic kidney resulting from a failure of certain portions of the secreting renal tissues to become connected with the collecting portion. Wilson<sup>2</sup> has called attention also to the probable development of the so-called hypernephromata as neoplastic growths from similarly unattached portions of the secreting portion of the kidney. The bifurcation of the end of the

ureter may be so extreme that an upper and lower kidney may be seen on one side with an upper cleft and a lower single ureter, or a complete cleft one, varying according to the point of division of the metanephric diverticulum. The attachment of the secreting substance across the spine may drag one ureter across the midline. Two ureters to one kidney are not uncommon and very rarely three ureters have been found as in the case reported by Bransford Lewis<sup>3</sup>. In the other each calyx has a short ureter, all delivering through one ureter into

FIG 4



Case No 11,425 —Division of ureter at lower third. Left branch crosses spine and leads to a large hydronephrosis of the left kidney. Right kidney normal.

the bladder, a form rarely seen in man. Kuster<sup>4</sup> observed the right ureter formed of three branches, two being from the isthmus, while Gebhardt<sup>5</sup> reports one with five branches. We have seen two ureters to one kidney with variously located divisions, in five cases other than in those of the horseshoe type. The openings into the bladder may not be abnormal, depriving us of the aid of the cystoscope alone in making a diagnosis (Figs 3, 4, 5, 6).

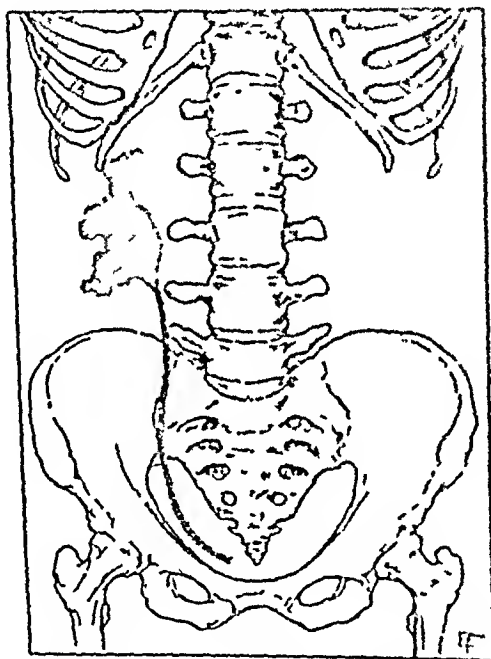
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FIG. 3



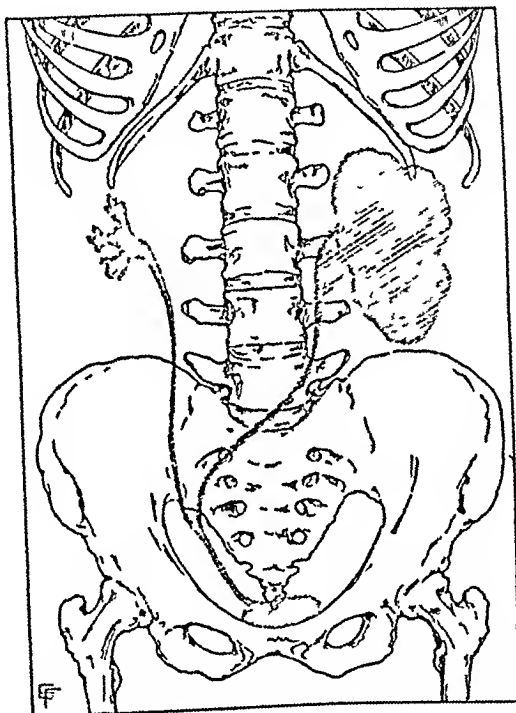
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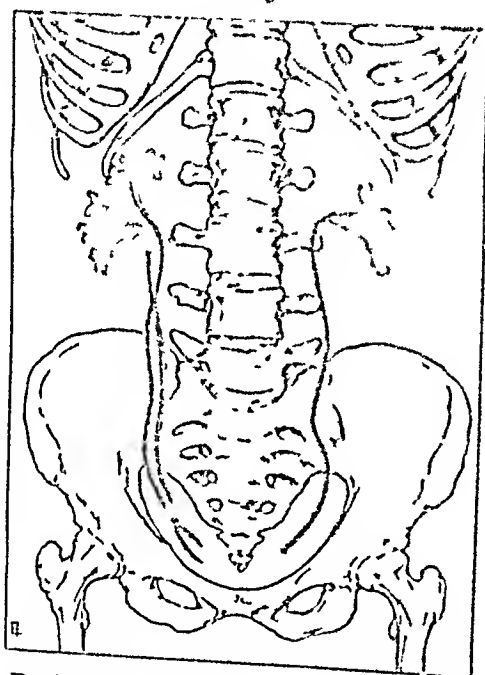
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The ureter normally is twelve inches long. In a low placement of the kidney it may still be long and coiled or very

short Thompson's<sup>6</sup> case of pyonephrosis in a horseshoe kidney had a meter but one and one-half inches in length.

As to the relative frequency of this anomaly it is difficult to say, since statistics vary so much. Those collected by Thompson<sup>6</sup> show one in 300 autopsies to those of others which place it as seldom as one in a thousand. Our own autopsy records in a single year have shown as high as four per cent of cases presenting gross anomalies of the kidney or ureter of surgical importance.

FIG 5

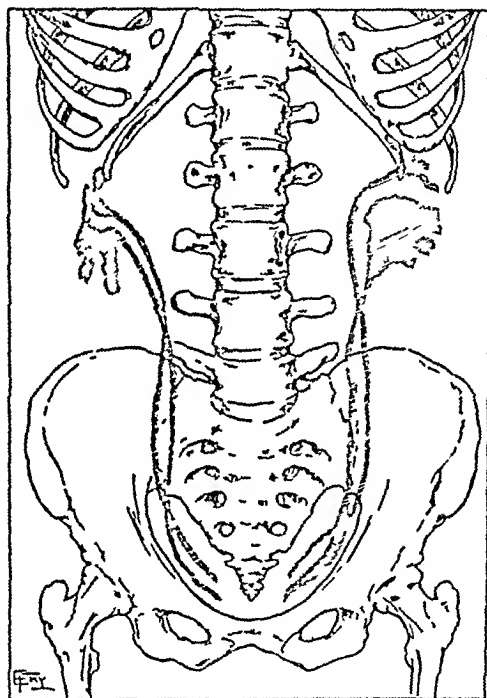


Case No. 10,962 — Duplication of the pelvis of right kidney and ureters. Normal

Of 36 cases of gross renal and ureteral anomalies observed during five years in our clinic, 7 were found incident to other abdominal operations. Among the total number were 12 of the horseshoe type and 6 of the congenital single or asymmetrical type. During this five-year period, 649 operations were made upon kidneys or ureters. Excluding those diagnosed and not operated on and the cases found at autopsy there was an average of one serious anomaly associated with the disease in every 26 cases, thus showing that such anomalies of kidney and ureter are often the cause of or are a contributing factor to disease of this structure (Figs 7 to 15).

Robinson's collected statistics show that in the horseshoe form 90 per cent are fused at the lower poles, and in the others it was reversed, the convex surface being upward. If the positions of the kidney are not symmetrical they are of the "L" shaped or irregularly fused form, the lower kidney being drawn to the midline. At the point of union there may be only connective tissues (in 15 per cent of the cases), usually, however, it consists of true renal tissue and varies

FIG 6



Case No. 13,529 —Bilateral duplication of ureters and pelves. Duplication left kidney pelvis complete, with small hydronephrosis of the lower pelvis. The two pelves of the right kidney united by common calyx.

from a small area to the full width and thickness of the kidney. Robinson found 90 per cent of cases fused in front of the great vessels.

Among the irregular forms are the sigmoidal—upper and lower pole fused—and the unilateral gross kidney.

Several classifications of horseshoe kidney exist. The oldest grouping by Neufville and Freund<sup>7</sup> admitted form as a criterion, the attachment being at the lower or upper poles. That of Forster<sup>8</sup> was based on the degree of fusion, regardless of the point of attachment. The classification of Heuer<sup>9</sup> was

based on situation and included unilateral and "J." shaped kidneys. That of Carlier and Gerard<sup>10</sup> is based on form and situation. They state that a horse-shoe kidney is a congenital malformation consisting in a connection more or less close of two similar poles of the kidneys in front of the spine showing more or less clearly the form of a horse-shoe with equal or unequal branches. They divided them into two classes, symmetrical and asymmetrical.

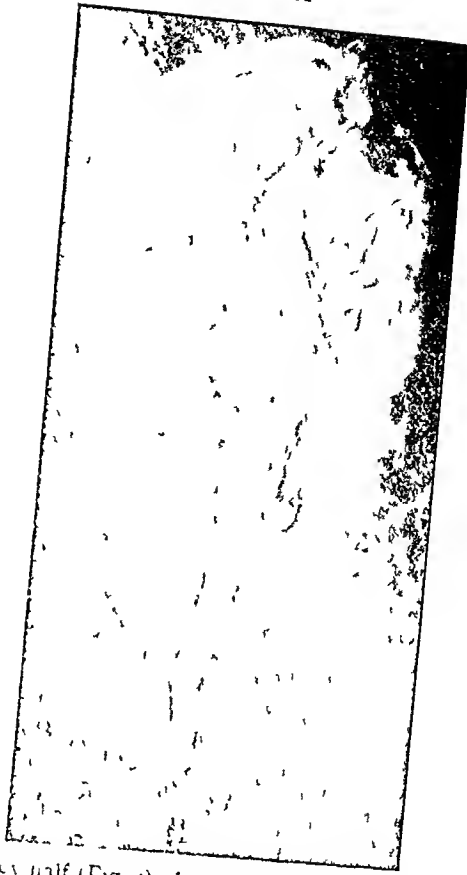
The most common disease affecting horse-shoe kidney is hydronephrosis, which later may develop pyonephrosis. Hydronephrosis occurs in moderately young individuals, while pyonephrosis and lithiasis, which also occasionally may be found in horseshoe kidney, are usually seen in middle age or later. All three of these conditions may be present in one side of such a kidney.

Tuberculosis is rarely seen, but when present is diagnosed by the usual symptoms of hematuria, disturbance of the bladder, and the finding of tubercle bacilli in the urine. It is located by cystoscopy and the separation of the urine from the two sides. König<sup>11</sup> and Gibbon<sup>12</sup> each report sarcoma of one-half of the kidney in children, both cases recovering from a transperitoneal removal of the growth. Cystic tumors of such kidneys which have necessitated the removal of one-half in one and puncture of cysts in another have been reported by Bockenheimer<sup>13</sup>.

With reference to sex, more horseshoe kidneys are found in women than in men and more single kidneys in men than in women.

For a long time the observations made on horseshoe kidney agreed that the condition could not be discovered save at operation or autopsy, except in those cases where the abnormal kidney attained a pathologic alteration. Since surgical interventions were rare, patients suffering from grave troubles, due to the presence of horseshoe kidney, died without the cause of their symptoms being ascertained. It is very probable that some of these conditions do not produce sufficient disability to cause the patient to consult a physician, especially when the connecting link between the kidneys is connective

FIG 11



Section of horse-shoe kidney half (Fig 1) showing (1) large hydro-ureter caused by stone in bladder, (2) pyonephrosis

FIG 12



Half of double kidney and ureter Removed at operation for stricture of ureter



Section of horse shoe kidney, (lateral view) showing the location of the ureters

Figure 1



Exterior of one half of horse-shoe kidney with ureter removed at operation

FIG 11



Section of horse-shoe kidney half (Fig 1) showing (1) large hydro-ureter caused by stone in bladder, (2) pyonephrosis

FIG 12



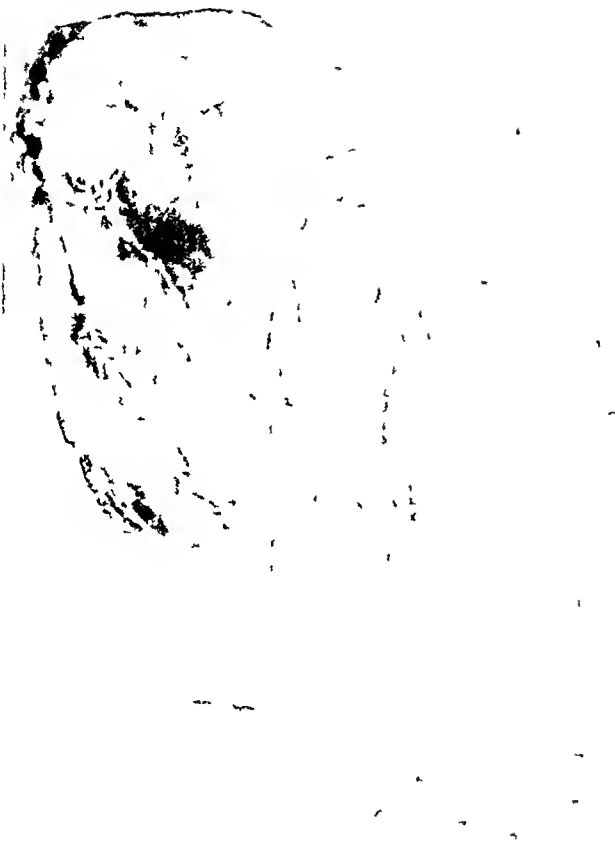
Half of double kidney and ureter Removed at operation for stricture of ureter





Half of horse shoe kidney    Removed at operation for hydrocephalus

FIG. 14



Note division of ureter into three parts (see note on page 10)  
(in open specimen)



Pelvic kidney showing blood supply arising at junction of iliac and aorta. Upper pole of kidney (Autopsy specimen)

tissue Heavy renal tissue so placed undoubtedly gives symptoms if we can rightly interpret them

Rovsing's <sup>14</sup> recently published cases of horseshoe kidney with operative verifications are very suggestive In three cases the same symptomatology was noted, the predominant symptom being pain experienced in the abdomen and lumbar region and beneath the epigastrium These pains generally radiate downward and usually manifest themselves while the patient is standing upright, being then almost continuous They are mitigated greatly by rest and disappear completely after prolonged rest in bed These patients suffer severely from continuous jarring and the suffering is increased by muscular effort, such as lifting Throbbing and a sense of pressure in the abdomen may occur and upon bending backward then discomfort is greatly increased From their situation such kidneys are more liable to injury, compression of the abdominal vessels may occur and a case of thrombosis of the iliac and femoral veins, causing œdema of the legs and ascites, as reported by Neufville <sup>15</sup>

In the diagnosis of horseshoe kidney the associated anomalies of the genital system are to be considered as they are developed together Such conditions are frequently noted with congenital kryptoorchidism, hypospadias, atresia of the anus, double or bicornate uterus, absence of vagina, etc Such cases have been reported by Tillmanns,<sup>16</sup> Gerster,<sup>17</sup> and others

goitre extending over a period of six years. The growth was the size of two oranges, symmetrical, movable, and painless. A diagnosis of cyst of the right lobe was made and the growth removed under local anæsthesia. There were many adhesions and much hemorrhage. The man recovered and left the hospital at the end of 21 days with the wound healed. The laboratory report was fibrosarcoma.

NASSETTE<sup>3</sup> reports a case of sarcoma of the thyroid as a recurrence of carcinoma, but I could not obtain even an abstract of his article for the present paper.

KOCHER says that sarcoma (aside from endothelioma) and carcinoma may occur in the thyroid at the same time, but that the combination is rare. He further says that it is remarkable that this combination has apparently been observed beyond the possibility of a doubt only in cases in which there was some doubt that the epithelial tumor in the thyroid was primary.

CHAVANEZ and PIERRE NADAL<sup>4</sup> report a case of tumor of the thyroid in a woman 64 years old, which was removed after it had existed a "long time," and which upon microscopic examination was found to contain sarcomatous areas together with ostoid, chondroid, and ordinary connective-tissue areas.

W H SNYDER,<sup>5</sup> of Kalamazoo, reports a case of sarcoma of the mediastinum which invaded the thyroid. The patient was a male aged 37. The symptoms, cough, difficult breathing, and hoarseness, antedated the appearance of the thyroid tumor three months. The tumor was very hard. One month after the first appearance of the thyroid tumor it was removed by operation. The cervical lymph-glands were also involved. The patient died 41 days after the operation from increasing obstruction to breathing and weakness. At the autopsy the tumor was found adherent to all neighboring organs except the left lung. No metastases were found outside of the mediastinum and neck. The specimen was submitted to Dr A S Warthin, of Ann Arbor, who reported as follows:

"The growth is a round-cell sarcoma, the majority of the cells being of the large round-cell type. There is no evidence of any leucæmic condition in the blood-vessels, and unless the process was localized in the lymph-nodes as a primary condition the tumor should be classed with the simple sarcomata. The thyroid is invaded, and there is no sub-pleural metastasis invading the lung tissue. If the lymph-nodes were the seat of the tumor process, the condition would fall into the group of aleucæmic, large-celled lymphosarcoma."

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<sup>3</sup> Policlínico, Rome, Oct, 1909, vol, No 10, 429-476, Jour A M A, vol lxx, p 1871, 1909 (only title given)

<sup>4</sup> Jour de med de Bordeaux, 1910, 51, p 817, Abs in Jahresbericht für Chirurgie, I, 1910, p 683

<sup>5</sup> Jour A M A, vol 1, p 766, 1908

way and the lower part of the incision completed. The twelfth rib is then cleared in its posterior portion upward and backward nearly to the articulation of the rib with the transverse process of the twelfth dorsal vertebra, and the pleura pushed upward. By retracting the erector spinae muscle on the one hand and the costal margin on the other, a wide exposure is accomplished at the point of previous inaccessibility. As a rule the kidney can readily be drawn through the incision to the surface with but little traction. The incision is easily closed and there is little or no danger of hernia."

As these cases will often be discovered during operation on the kidney the possibility of horseshoe kidney must be considered when it is unusually difficult to deliver the lower pole. This occurred in my last case, one of pyonephrosis of half of the horseshoe kidney. The renal tissue nearly the full size of the normal kidney passed in front of the large vessels. After examination of the blood supply, which is so frequently abnormal in such cases, this tissue was divided and sutured with catgut. In a case that was not pathologic other than the abnormality, Rovsing relieved the pain and general symptoms by division of the isthmus.

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- <sup>4</sup> Kuster. *Deut Chir*, III, 241
- <sup>5</sup> Gebhardt. *Rayer*, vol III, p 771
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- <sup>7</sup> Neufville and Freund. Quoted by Carlier and Gerard, *Rev d Chir* July and Aug, 1912
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- <sup>9</sup> Heuer. *Ueber Hufsenmieren*, Diss, Leip, 1902
- <sup>10</sup> Carlier and Gerard. *Rev d Chir*, July and Aug, 1912
- <sup>11</sup> König. *Deut Ztschr f Chir*, VI, 92
- <sup>12</sup> Gibbon. *Rev d chir*, 1909, 1265
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- <sup>15</sup> Neufville. *Loc cit*
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# THE EMBRYOGENETIC RELATIONSHIPS OF TUMORS OF THE KIDNEY, SUPRARENAL, AND TESTICLE \*

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## INTRODUCTION.

THE urinogenital system presents more gross and microscopic anomalies than any other set of organs in the human body. This is because nature in the development of the organs pursues an indirect and wavering course. Nowhere else in the body are organs in the embryo first developed to a stage in which, like the mesonephros or Wolffian body, they present all appearance of being capable of active function, then only to degenerate and have their remains utilized for the building of new structures as the permanent kidney and testis. It is only by a study of the details of the intricate combinations and recombinations of the primitive factors which are used in the making of the urinogenital system that we shall come to understand in the adult either the gross surgical anomalies or those more obscure aberrations which appear to contain the explanation of the puzzling tumors of the kidney and testis. The busy surgeon and the engrossed pathologist are both apt to overlook the enormous amount of accurate detailed observation which is being made by embryologists on the development of the urinogenital system. The last decade has seen an almost complete revolution in our ideas of the essential embryology of the system and there are yet many obscure points which would appear to have a direct bearing upon its pathology. I wish herein to call attention to the chain of relations, to which new links have recently been

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added, between the development of the organs in question and their pathology

Huntington's <sup>†</sup> Harvey lecture of 1907 gave such an excellent summary of the gross anomalies of the genito-urinary tract that it is unnecessary to again cover the field. I shall therefore confine myself to a consideration of the more minute embryologic anomalies which concern the development of tumors, based on a study of the operative and autopsy material from the Mayo clinic and consisting of the following renal tumors, 92, adrenal tumors, 3, testicular tumors, 21

This material has been supplemented also by a study of the human and comparative embryology of the regions under discussion

### RENAL TUMORS

In considering the embryologic relationships of the renal tumors, one groups them most conveniently into (*a*) tumors of the pelvis and collecting tubules, (*b*) tumors of the cortex, and (*c*) tumors of the capsule

(*a*) *Tumors of the Renal Pelvis* Most of the tumors of the renal pelvis—papillomas and carcinomas—apparently arise secondarily to chronic irritative processes of the pelvic epithelium and have no embryologic significance. Our series contains three pelvic papillomas, all of the angiocystic type, developing in the collecting tubules in the apices of the Malpighian pyramids. The four renal carcinomas in our series have taken their origin similarly in the collecting tubules, and two of these are demonstrably superimposed on extensive renal calculus formation

There is, however, one tumor of the renal pelvis in our series which is apparently of embryogenetic origin. This is a squamous-celled epithelioma resembling histologically a cancer of the lip and evidently derived from the ectoderm. The explanation of the presence of ectoderm within the renal pelvis in this case is as follows

The renal pelvis with its collecting tubules develops from the primary excretory or Wolffian duct. The primary ex-



cretory duct is initially the excretory duct of the pronephros. It is developed from the principal tubules of the pronephros which begin as evaginations of the mesoblastic parietal layer of each primitive segment stalk. It enters the cloaca low down on that structure at a point close to its rectal portion. Before the opening occurs, however, the lumen of the cloaca may be seen to evaginate into the blind end of the primary excretory duct. It will thus be seen that though the primary excretory duct is normally composed entirely of mesoblast, there is a possibility, as an abnormality, of ectodermal cells from the rectum being carried into its lower end by way of the cloacal wall. No other way appears by which one may account for the occasional though rare presence of these squamous-celled epithelial tumors within the renal pelvis.

(b) *Tumors of the Renal Cortex* Occasionally a renal carcinoma, arising in the renal pelvis or collecting tubules, so involves the renal cortex that its pelvic origin cannot be positively determined. There are two such in our series. Occasionally also a renal sarcoma in the adult developing in a fibroma which has apparently had an inflammatory origin within the renal capsule may similarly so involve the renal cortex that its true point of origin is with difficulty made out. Much more rarely, I believe, do we have a primary spindle-celled sarcoma of the renal cortex arising from the adult connective tissue. There is but one of these of undoubted diagnosis in our series. This case is that of a girl sixteen years of age. As one reviews the literature, he is convinced that most of the renal tumors which have been diagnosed as sarcomas are in reality mesotheliomas or embryomas (Wilms's<sup>3</sup> tumors).

Our series contains two positively diagnosed and one doubtfully (exploratory operation) diagnosed embryomas or Wilms's tumors, one of these occurring in a child two years and the other two in children each five years of age. These tumors trace their embryologic relationship back to the formation of the nephrogenic cord, that portion of the mesothelium from the lower end of which is formed the secreting portion of the permanent kidney. In the very early embryo, the mesoderm forms a wedge-shaped plate on either side of the

medullary tube This mesodermal plate early differentiates into three portions—a thick primitive segment (next the medullary tube), a constricted primitive segment stalk, and a thin lateral plate The constricted primitive segment stalk furnishes the material from which the tubules of all three nephritic organs are developed From the lateral plate are developed, among other things, muscle and cartilage As the nephrogenic cord develops from the primitive segment stalk, it is in immediate apposition to the bases of the lateral plates, and it is perfectly possible for tissue from the lateral plate area to be included within the formation of the nephrogenic cord This is especially true in the caudal portion of the nephrogenic cord, which here lies closer to the lateral plate than it does in its middle and cephalic portions Now it is from the extreme caudal portion of the nephrogenic cord that the cortex of the permanent kidney is developed Accordingly, we should expect to find here, if anywhere within the nephrogenic structures, inclusions of the lateral plate and subsequent developments therefrom of embryonic muscle, cartilage, etc These are the structures which, along with other embryonic cells and tubules, give the diagnosis to the so-called mixed tumors of Wilms

By far the most numerous tumors of the kidney are the mesotheliomas (so-called hypernephromas or Grawitzian tumors) of the renal cortex I had the pleasure three years ago<sup>12</sup> of reporting before this society 32 cases of hypernephromas from the Mayo clinic Since then, I have studied 22 more such cases from our clinic, making 54 in all, and tissues from 14 cases from the University of Minnesota clinic, or a total of 68 cases Besides the 54 cases which have been diagnosed pathologically in our clinic, there are 17 cases which were diagnosed by the surgeon upon exploratory operation, making a total of 71 cases of mesothelioma out of a total of 92 renal tumors, or 78 per cent of all tumors of the kidney removed

Grawitz's<sup>1</sup> hypothesis of the derivation of these tumors from adrenal rests was based upon the following (1) the tumors are situated immediately beneath the capsule of the

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It will be recalled that as the primitive renal pelvic bud—derived from the primitive excretory (Wolffian) duct—grows dorsally from its point of origin, it is surrounded by a cap of mesothelial tissue, the metanephrogenic cord, which is the caudal extremity of the mass of mesothelium from the forward end of which has been previously elaborated the Wolffian body. After the first two or three branchings of the renal pelvis, at each later subdivision for the elaboration of the collecting tubule system, this cap of nephrogenic tissue is separated into masses, one of which remains surrounding the terminus of each of the growing collecting tubules. In the later subdivision of the tubules, masses of the nephrogenic tissue are also left in the angles of the branching tubules. The nephrogenic cells of each of these small masses soon arrange themselves as an oval or spheroid about an excentrically placed point which soon becomes a cavity, thus making of the cell mass a small elongated ovoidal vesicle. This vesicle then becomes fused at its lesser extremity with the end of the collecting tubule. From the vesicle are normally formed the renal glomeruli, the convoluted tubules, the loop of Henle and the uriniferous tubules up to the straight collecting portion which is derived from the primitive renal pelvic bud.

For a long time it has been considered that the failure of the nephrogenic vesicles to form a tubular connection with the collecting tubules is responsible for the condition of congenital cystic kidney. A study of the development of the nephrogenic vesicle, however, has convinced me that such a failure in its embryonic development is responsible for much more than the formation of renal cysts. Primarily, the nephrogenic cap consists of somewhat darkly staining, round, and irregularly arranged embryonic cells. In the first stage of the formation of the vesicle, it is a solid mass of cells which is frequently somewhat elongated and presenting a cordon-like appearance. In its second stage it is first an ovoidal vesicle and then a tubule. Now all these embryonic pictures closely resemble those which we find making up the histologic elements of the Grawitzian tumors. I have therefore urged the hypothesis that these tumors are mesotheliomas, or more definitely neph-

kidney, (2) their cells are different from those of the epithelium of the uriniferous tubules; (3) the cells contain fat which is normally absent from the renal epithelium but frequently present in the suprarenal epithelium, (4) the capsule of the tumor is similar to that which is found around suprarenal rests within the kidney but which are not changed into tumors, (5) the cells of the tumors are sometimes disposed in more or less regular cordons which resemble those of the suprarenal cortex

Grawitz's hypothesis was accepted by most observers during the next quarter of a century following its formulation. During this time it was attacked by Suckek - and finally quite effectively by Stœrck,<sup>6</sup> who showed that

(1) The Grawitzian tumors most frequently develop at the lower pole of the kidney where adrenal rests are not found, (2) the so-called fat of the cells of the Grawitzian tumors is usually not fat but a vacuolation related to the glycogen content of the cells, (3) the Grawitzian tumor is a tumor of the renal cortex and not of the renal capsule in which adrenal rests are usually found, and that (4) though the Grawitzian tumors do frequently contain cordons, which, however, only remotely resemble those found in the suprarenal, yet they also almost invariably contain tubules, the analogues of which are never seen either in the normal suprarenal or in the tumors of that gland

Stœrck's very convincing evidence and arguments against the Grawitzian hypothesis I have been able fully to support by a study of our own cases, as have also the observations of Jelle,<sup>7</sup> Trotter,<sup>8</sup> Zehbe,<sup>10</sup> Sisson,<sup>11</sup> and Glynn.<sup>15</sup>

It has seemed to me from the first, however, that there are serious objections to Stœrck's suggestion that these neoplasmas arise from regenerating convoluting tubules in the atrophic kidney. After a careful study of the embryology of the kidney and of the histologic structure of 48 cases, I proposed three years ago<sup>13</sup> the hypothesis that these tumors are really derived from islands of nephrogenic tissue which have failed to become connected with the renal pelvis, through the collecting tubules, of the developing kidney.

It will be recalled that as the primitive renal pelvic bud—derived from the primitive excretory (Wolffian) duct—grows dorsally from its point of origin, it is surrounded by a cap of mesothelial tissue, the metanephriogenic cord, which is the caudal extremity of the mass of mesothelium from the forward end of which has been previously elaborated the Wolffian body. After the first two or three branchings of the renal pelvis, at each later subdivision for the elaboration of the collecting tubule system, this cap of nephrogenic tissue is separated into masses, one of which remains surrounding the terminus of each of the growing collecting tubules. In the later subdivision of the tubules, masses of the nephrogenic tissue are also left in the angles of the branching tubules. The nephrogenic cells of each of these small masses soon arrange themselves as an oval or spheroid about an excentrically placed point which soon becomes a cavity, thus making of the cell mass a small elongated ovoidal vesicle. This vesicle then becomes fused at its lesser extremity with the end of the collecting tubule. From the vesicle are normally formed the renal glomeruli, the convoluted tubules, the loop of Henle, and the uriniferous tubules up to the straight collecting portion which is derived from the primitive renal pelvic bud.

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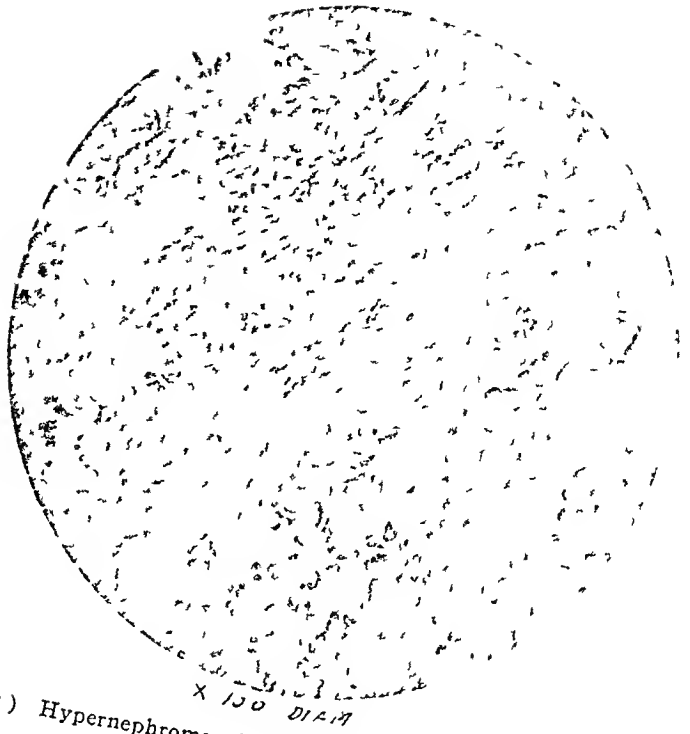
romas, that is that they are elaborated from masses of nephrogenic tissue which have never become connected with the renal pelvis and which have never attained adult type in either form or function. In fact, I feel sure that as the evidence continues to accumulate, it will show first that the so-called Grawitzian tumors have nothing whatever to do with a suprarenal origin, and second that they are true mesotheliomas (nephromas) arising from masses of nephrogenic tissue, the normal embryologic development of which has been arrested or perverted *after* the beginning of the development of the kidney proper.

(c) *Tumors of the Renal Capsule* That the renal capsule is not infrequently the site of tumors forming in its adult tissue is well demonstrated. Fibromas and in their wake spindle-celled sarcomas are not rare. Our series contains one of the former and two of the latter type, all arising in adults beyond 35 years of age. These sarcomas of the renal capsule are apt to invade the renal cortex and be mistaken for tumors arising in this portion of the organ.

As far as its embryologic relationships are concerned, the renal capsule is frequently the site of inclusions from the mesonephros, Wolffian body, and occasionally, though rarely, of inclusions from the suprarenal. The beginnings of the renal capsule are seen as embryologic connective tissue concentrically arranged about the embryonic kidney as early as in 13 mm embryos, though the actual capsule, well differentiated from the surrounding tissue, is not observed until we reach 70 mm embryos. In the early stages of capsular development, the degenerating tubules of the Wolffian body lie in immediate apposition to, or indeed commingled with, the embryonic connective-tissue fibres which enter into the formation of the capsule. Consequently the inclusion of masses of the degenerating Wolffian tubules in the renal cortex is very easily understood. We have in our series one well-marked case of this type, that is, an encapsulated mass of Wolffian tissue lying within the renal cortex.

Though it is true that undoubted inclusions of suprarenal tissue have been found in the renal cortex, I am convinced

FIG 9



(Case A 72057) Hypernephroma of adrenal Photomicrograph  $\times 100$  diam

FIG 10



Kidney and adrenal

Spleen

Metastatic cells

(Case A 75198) Hypernephroma of adrenal with metastases to spleen and kidney

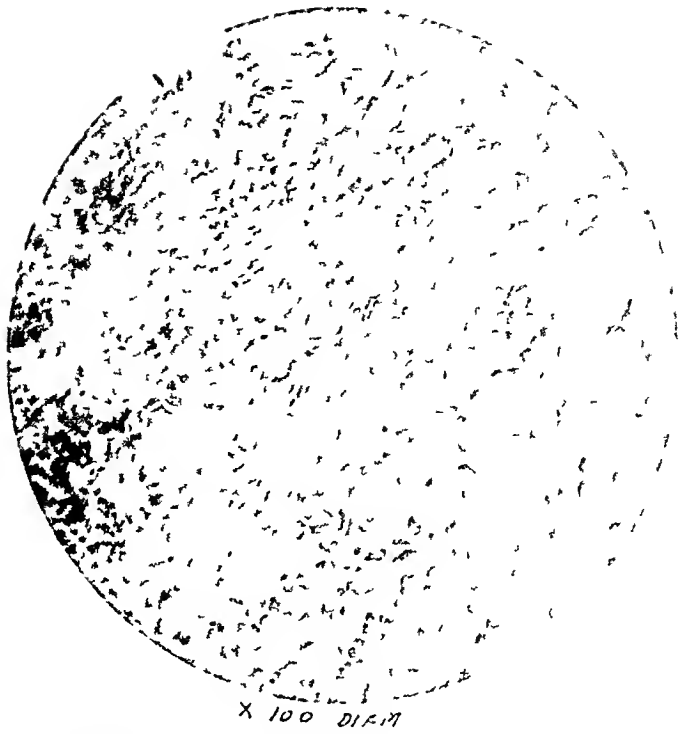


Fig. 7



(Case A 72057) Hypernephroma of adrenal

FIG 9



(Case A 72057) Hypernephroma of adrenal Photomicrograph / 100 diam

FIG 10



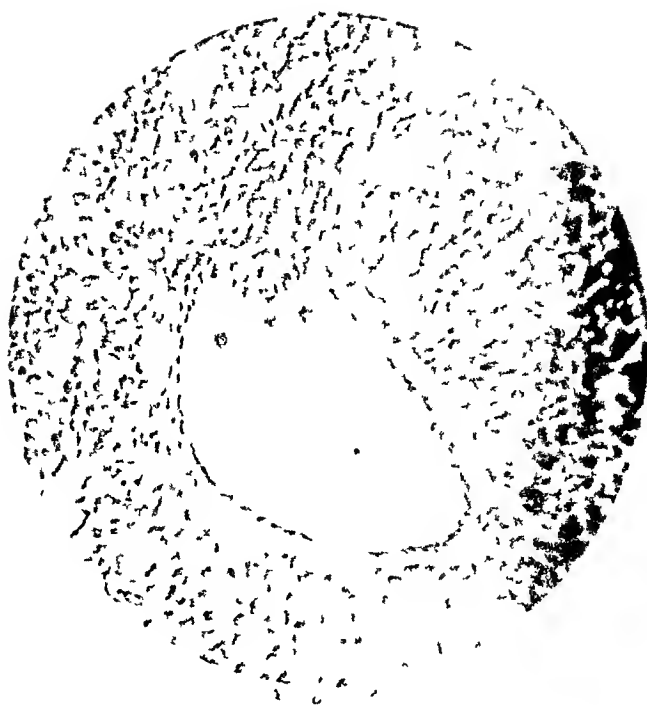
Kidney and adrenal

Spleen

Liver

(Case A 75198) Hypernephroma of adrenal with metastases to spleen and liver

FIG 11



(Case A 75198) Hypernephroma of testis. Photomicrograph,  $\times 100$  diam

FIG 12



$\times 100$  DIAM

(Case A 39407) Teratoma ('alveolar carcinoma') of testis. Photomicrograph,  $\times 100$  diam

that they are much more rare than they are usually supposed to be. Several pathologists with an extensive post-mortem experience state specifically that they have never personally observed a single instance. Glynn<sup>15</sup> in a recent careful survey of the literature has collected 17 cases, to which he adds two cases of his own. To these we may add one case from our autopsy records. They are usually well encapsulated, though at least one instance has been reported in which there was no visible connective tissue between the mass and the kidney structure.

Glynn notes the following facts opposed to the hypothesis that adrenal hypernephromas arise from the remnants of adrenal cortex:

(a) The histologic dissimilarity between tumors of the renal and adrenal glands

(b) Renal tumors never influence growth of sexual characteristics

(c) Why should adrenal rests, though comparatively rare in the kidney, produce hypernephroma, the commonest renal tumor, while adrenal rests in other localities, though comparatively common, so rarely produce tumors, either benign or malignant?

While it is perfectly conceivable that such masses within the renal cortex may form malignant neoplasms, I find neither in the literature nor in my own experience any evidence that such is the case. Should such tumors form, they must, to satisfy the present demands of diagnosis, conform to the histologic type of those tumors which we know to be primary in the suprarenal. In other words, it is but fair to assume that a neoplasm derived from wandering suprarenal cells will present the same histologic elements as neoplasms derived from suprarenal tissue in its normal position.

#### TUMORS OF THE ADRENAL GLAND

The well-known fact that the cortex and medulla of the suprarenal are derived from different embryologic structures accounts for the great diversity of tumors of this gland.

The medulla is chromaffin tissue derived from the sympathetic nervous system and the cortex is derived from the coelomic epithelium Glynn<sup>15</sup> has recently reviewed the pathology of the rests and tumors of the adrenal cortex His summary and conclusions in part are as follows

"1 Tumors (of the adrenal) are rare, especially primary malignant tumors, which are represented by (a) round-celled sarcoma and (b) adrenal hypernephroma, an epithelial growth of cortical origin"

"2 Adrenal hypernephromas are associated with sex abnormalities almost invariably in children, usually in adult females before the menopause, but apparently never in adult females after the menopause, or in adult males"

A recent study of three tumors of the suprarenal which have come to our clinic adds additional evidence to the above The first of these tumors of the suprarenal was in a woman (Case A6685) 41 years of age, who for 14 years had had hæmaturia at irregular intervals with pain in the right kidney, accompanied recently by dysmenorrhœa and considerable loss of weight A clinical diagnosis of hæmaturia from chronic infection of the renal pelvis was made At operation, the right kidney was found with a very thin cortex and a distended pelvis the seat of chronic inflammation and giving abundant evidence of the hæmaturia An encapsulated tumor as large as a hen's egg was found above the kidney but pressing somewhat upon the ureter Histologic examination of this tumor shows it to be an adenoma of the adrenal cortex

The second case was a man 47 years of age, who, like two cases quoted by Glynn, had been noted for years for his enormous strength He had been perfectly well until three months before the examination, when, after great exposure on a five days' tramp through slush and snow in Alaska, he developed pain and a tumor mass in the epigastrium When brought to the clinic, there were multiple tumor growths over his trunk, head, and neck One of these from the axilla was excised and on histologic examination a tentative diagnosis of hypernephroma was made The disease steadily progressed and the patient died four months after the onset of symptoms Autopsy revealed large tumors occupying the position of each suprarenal There were small

metastatic nodules in each kidney, many large ones in the omentum, in the spleen, in the liver, in the heart wall, in the lungs, and in the lymphatics generally throughout the body. A careful histologic study of this tumor shows it to be composed almost entirely of large polyhedral cells with some multinucleated giant forms and a few smaller round cells, a typical hypernephroma of the adrenal cortex.

The third case was a man 68 years of age who had had "stomach trouble" for four months. Surgical exploration revealed numerous small tumors of the peritoneal glands and small intestine. The patient died four days later of pulmonary embolism. Autopsy revealed large necrotic tumors completely involving both suprarenals with metastases to the peritoneal glands, small intestine, spleen, and liver. Microscopically, the tumors are large, round and polyhedral-celled hypernephromas of the adrenal cortex.

These three hypernephromas of the adrenal cortex form an interesting series for comparison with the so-called hypernephromas of the renal cortex. The first case still recognizedly preserves the cordon structure of the adrenal cortex, and yet one would not hesitate to differentiate it from the cordons found in renal tumors. The two latter cases, which were far advanced and are parallel in their stage of development with most of the renal tumors in our series, have lost almost entirely all evidence of cordons. Their cellular structure, however, could not by any possibility be mistaken for any of the pictures found in our series of renal tumors. It is also especially interesting to note that the fat content of the cells of the adrenal tumors is very high, not only in the primary tumor but also in the metastases, including those in the kidney itself. This is in marked contrast to the almost if not entire absence of fat in the cells of renal tumors.

While these adrenal hypernephromas are of particular interest to the clinician in the light which they throw on the functions of the adrenal in relation to sex development, they are of quite as great interest in the negative evidence which they supply concerning Grawitz's hypothesis of the suprarenal origin of renal tumors.

## TUMORS OF THE TESTICLE

Ewing's<sup>14</sup> article on tumors of the testis two years ago has left little room for discussion unless based on evidence furnished by new material. In brief Ewing concludes:

"(1) Pure fibromas and pure leiomyomas of the testis exist but are extremely rare, as is also adenoma occurring in atrophic undescended testes"

"(2) Primary lymphosarcoma and pure spindle celled sarcoma are of uncertain origin"

"(3) Chondroma, myxoma, lipoma, rhabdomyoma, and carcinoma have not been shown to exist apart from a teratomatous origin"

"(4) Alveolar large round celled perivascular and other forms of so-called sarcoma testis are of epithelial and teratomatous origin"

"(5) The commonest tumor of the testis is an embryonal carcinoma, alveolar or diffuse with polyhedral or rounded cells and often with lymphoid stroma. These tumors are probably one-sided developments of teratomas"

"(6) Teratoma testes arise from sex cells in the neighborhood of the rete whose normal development into spermatogonia has been suppressed but whose potencies remain intact and ready to express themselves in the various forms of simple or complex teratomas"

Our series of tumors of the testicle contains 21 cases, two of which were exploratory only, each apparently a sarcoma of an undescended testicle. The histology of the other 19 cases has been studied in detail. Though the specimens vary a great deal in their relative cell content, every one of them would undoubtedly be classed as a teratoma by Ewing. Eleven of the 19 are alveolar embryonal carcinomas with rounded or polyhedral cells, 5 show cartilaginous and 7 myxomatous tissue with their structure. From a clinical stand-point it is somewhat interesting to note that 6 of the 19 cases give a history of injury definitely related to the onset of symptoms in the injured testicle.

Ewing's hypothesis is that these teratomas of the testicle arise from sex cells whose normal development has been suppressed. This is interesting in relation to the recently published observations of Felix<sup>15</sup> on the presence of wandering genital cells in early human embryos. Felix has found in a careful search of all of the tissue in a human embryo of 26

mm (13 pairs of primitive segments) 7 genital cells, all in the immediate vicinity of the cloaca and all between it and the visceral mesoblast. In an embryo of 2.5 mm (23 primitive segments), he found 12 primary genital cells in the same locality. Felix observes that "if these wandering genital cells are strays, they perhaps do not degenerate but may further develop, and above all divide, forming parent cells for tumors and especially for teratomas."

The genital cells are the most important cells of the reproductive glands. Until recently embryologists described their derivation from the coelom. Recently, however, much evidence has been accumulating to show that their origin is directly from the segmentation of the ovum and it is possible that the future sex of all the genital cells is already determined at fertilization. Whether these genital cells differentiate into spermatogonia or oogonia is still unsettled. On the other hand, it is readily determined that the indifferent reproductive gland does change into testis or ovary as the case may be. In the male, this change is clearly shown in 13 mm embryos. It consists of the appearance of anastomosing epithelial cords and the development of the tunica vaginalis between these cords and the surface epithelium. The testis cords are initially composed of indifferent epithelial cells with darkly staining nuclei. The genitaloid cells lie irregularly between these. They are found present at the time of the earliest appearance of the cords. Some of the genitaloid cells by the time the embryo has reached 70 mm in length have developed into genital cells. Branca and Bresseta<sup>5</sup> have shown that, while the number of genital cells in the testicle increases up to birth, after birth they entirely disappear and the tubules of the testis contain indifferent cells only. At puberty a new growth of genital cells is developed and from these are formed the spermatozoa. Popoff<sup>9</sup> has confirmed these observations, which would seem to have an important bearing upon Ewing's hypothesis of the formation of testicular teratomas from genitaloid cells. This wide gap between the genitaloid cells of the embryo and those which form at puberty may account for the great variation in type and speed of development of the teratomas of the testicle.



## SUMMARY

## RENAL TUMORS

1 Of 92 renal tumors studied, there were 3 pelvic papillomas, 4 carcinomas, 1 squamous-celled epithelioma, 1 adenoma, 1 fibroma, 7 sarcomas, 1 Wolffian tumor, 3 embryomas (Wilms's tumors), and 71 mesotheliomas

2 The renal papillomas and carcinomas apparently arise secondarily to chronic irritative processes of the adult pelvic epithelium

3 The rare squamous-celled epithelioma probably is a neoplastic development from the embryonic inclusion within the renal pelvis of ectoderm which has found its way into the lower end of the primitive excretory duct by way of the cloaca

4 The embryomas of the renal cortex composed of renal and other tissues and occurring in young children are, according to Wilms, derived from inclusions of the lateral embryonic plate within the caudal portion of the nephrogenic cord in the early embryo

5 The most numerous tumors of the renal cortex, the so-called hypernephromas or Grawitzian tumors, are apparently mesotheliomas derived from nephrogenic vesicles which have failed in the early embryo to form a tubular connection with the renal pelvis

6 Most of the few true sarcomas of the kidney develop primarily in adult tissue of the renal capsule and involve the cortex secondarily

7 The renal cortex is also frequently the site of inclusions from the mesonephros and rarely of inclusions from the suprarenal gland. Rarely if ever do either of these inclusions in the renal cortex form malignant tumors

## ADRENAL TUMORS

8 Of the three primary tumors of the adrenal studied, one was an adenoma and the other two hypernephromas of the adrenal cortex

9 Primary malignant tumors of the adrenal are either round-celled sarcomas or more frequently hypernephromas arising from the adrenal cortex

10 Adrenal hypernephromas frequently induce abnormalities of sex and strength

11 Tumors of the adrenal, in whatever stage of their development, bear no histological resemblance to most mesotheliomas (so-called renal hypernephromas)

#### TESTICULAR TUMORS

12 Of the 21 tumors of the testicle, all of the 19 which it was possible to study in histologic detail were teratomas

13 So far as can be determined, the history and histology of these 19 cases are in harmony with Ewing's hypothesis that teratomas of the testicle arise from sex cells whose normal development has been suppressed

14 The difference in time of development of the embryonic crop of genitaloid cells and the next generation which appears at puberty may account for variations in structure and *tempo* of the testicular teratomas

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## EXCISION AND SUTURE IN THE TREATMENT OF DENSE, CLOSE, URETHRAL STRICTURES

BY CHARLES GREENE CUMSTON, M D,

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THE majority of strictures of the urethra yield to simple dilatation or dilatation following internal urethrotomy, but the same cannot be said of the traumatic variety. Of the various types of trauma, urethral rupture is by far the most important, particularly when the lesion is seated in the bulbopерineal region, because here the solution of continuity is the most extensive. A number of most important signs accompany these ruptures, being usually early in appearance and unique, while those arising in the inflammatory type are multiple and slow in development. The traumatic stricture is to the feel like a callus in the urethral wall, and as it is very retractile there is a marked tendency to tight stenosis, from which a serious ultimate condition of affairs ensues.

In cases of impassable stricture an imperative interference is required, as the patient either presents complete retention or micturates by overflow. Puncture of the bladder, which is inoffensive, may be resorted to, but this merely is an expedient for temporary relief, and since both external and internal urethrotomy is generally a failure, resection of the stenosis, followed by end-to-end suture of the canal, with temporary deviation of the urine is the only truly effective surgical method for completely and permanently restoring the calibre of the canal.

As to the utility of resection, opinion is unanimous, but the same cannot be said of reconstruction of the urethra. Once the resection done, the choice is offered between secondary union, immediate end-to-end suture, simple urethrostomy, and, lastly, urethrorrhaphy with deviation of the urine.

Secondary union without sutures with a permanent catheter in the bladder has given unsatisfactory results, and it is quite safe to assume that a complete recovery never occurs. The end-to-end suture does not always give favorable ult-

mate results, although the immediate results may be good with an apparent union by first intention. But primary union is very difficult to obtain, and a slight infiltration often takes place around the temporary catheter, so that not infrequently some sutures must be removed. Now, whenever secondary infiltration occurs around a suture, it is practically certain that a new callus will develop around the canal, so that it is a matter of impossibility to obtain perfect results. After a time these patients return with diminished calibre and symptoms of stenosis.

Generally speaking, these two operations obligate the use of the permanent catheter during the process of repair, and if in some fortunate instances this procedure does not appear to present inconveniences, nevertheless often a seropurulent oozing appears in the wound on the second or third day and a few days later the wound finally disunites to a certain extent, so that primary union has failed. And even if primary union does not fail after circular urethrorrhaphy has been done, a new stenosis will ultimately arise. I believe that the temporary catheter is to blame, as its various manners of detrimental action are readily understood. In the first place it is a foreign body and like all these, even when aseptic, it is bound to set up an irritative process beginning as in a serous exudate which is not long in becoming purulent if the urethra is only mildly infected. Even in the case of a virgin urethra, the saprophytes of the canal easily develop as in a culture tube in the secretions enclosed between the catheter and urethral walls. The evident result is that union by first intention is seriously compromised.

The permanent catheter is used to isolate the urine from the urethra, and in spite of appearances this *desideratum* is not realized and this for many evident reasons, such as occlusion of the catheter, faulty introduction of the instrument, and simple capillarity. If the eye of the instrument becomes occluded with mucus or clot, the urine must of necessity flow along the walls and thus come in contact with the suture. Then, in spite of every care in properly placing the catheter it is next to impossible to prevent a trifling amount of urine from stagnating in the neck of the bladder before it reaches

the eye of the instrument. This stagnating urine will find its way out along the outside of the instrument, either from simple capillary action or from contraction of the bladder, and what is far more serious, this urine will be retained at the level of the sutures for the very good reason that at this point the canal hugs the catheter tightly on account of the sutures.

All this goes to prove that the use of the permanent catheter is particularly serious, because it results in preventing primary union. Orchitis from the use of the instrument is frequent, so much so that it is hardly necessary to refer to it. For these reasons I feel that the employment of the permanent catheter should be discarded in the cases under discussion.

Urethrostomy is a temporary gun-barrel suturing of the two ends of the urethra to the perineum after rupture or operative wound of the canal, and has been resorted to by those operators who have found that immediate end-to-end suture was unsatisfactory or even disastrous on account of the permanent catheter. Another indication for this procedure is the too considerable separation of the two ends of the canal resulting from an extensive resection so that the tension after end-to-end anastomosis would compromise the operative results. But this reason has lost much of its value, because, contrary to what is present in traumatic ruptures, in stricture there is usually a distinctly defined and limited hard area. And even in instances of extensive external urethrotomy, one can dissect a good amount of the anterior end of the urethra, quite enough in extent to be able to easily bring it into approximation with the posterior end. It is evident that urethrostomy necessitates a second interference two or three months later in order to close the perineal meatus and reconstruct the canal. At present some operators are resorting to this technic in cases of traumatic rupture successfully, but the operation is complicated and necessitates two sésances and, excepting the very fortunate cases, the results *à priori* should not be favorable for the maintenance of the calibre of the urethral canal.

We now come to the procedure of choice, in the writer's opinion, for the treatment of traumatic or inflammatory strictures, when the latter present analogous conditions

behind the point of suture, the bulbous portion is incised longitudinally for about two centimetres. The knife should be directed forward and upward and should progress toward the pubis so as to come in contact with the sound, which serves as a guide. When the urethra has been reached a buttonhole one centimetre long is made in it and the borders seized with clips, the sound is then withdrawn and a catheter is passed into the bladder through the buttonhole (Fig 5). When its correct position has been ascertained it is held in place by two silkworm-gut sutures passed through the border of the cutaneous incision.

The operation is completed by approximation of the soft structures, but when resection of the perineum has been extensive on account of many fistulous tracts the approximation will not be complete. An opening must be left behind the catheter to allow drainage of the fluids from the wound. Therefore, the skin is only sutured over its anterior two-thirds and then a small drain is placed in the opening left in front of the deviation catheter.

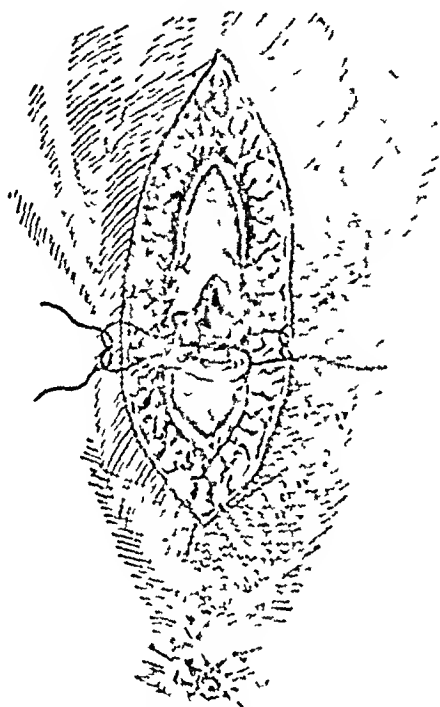
Let us now consider briefly those cases where the posterior end of the urethra cannot be found after a careful search, which should never be too prolonged. Naturally, retrograde catheterization is to be resorted to, and under these circumstances the suprapubic opening in the bladder will be used for the deviation of the urine and the buttonhole in the urethra becomes unnecessary.

If, now, the stricture is located so far back that the deviation must be obtained either by a catheter placed in the lowest part of the wound, through the membranous urethra, or, after dissecting off the rectum through the prostatic urethra, it is the writer's opinion that suprapubic drainage is to be by all means preferred, as it avoids infection of the urethral wound from the catheter.

The care of the deviation catheter is of the utmost importance and its proper functioning must be carefully supervised. The bladder should be washed out daily through the catheter with a 1:2000 silver nitrate solution, but the anterior urethra should never be washed out, as it is an error to fear infection of the sutures from this source. Likewise no

portion of the urethra without including the mucosa and then through the posterior end. A large sound is now passed into the bladder and the two sutures are tied. The remaining sutures are then inserted with the sound in place and thus it will be seen that all knots are outside the canal. A large sound is essential because the moulding of the canal is made around it and it is of importance to have the dimensions as large as possible.

FIG. 1



Approximation of the ends of the urethra after excision of stricture showing method of suturing

The introduction of the sound from the anterior to the posterior end is rather delicate, and an angular instrument is to be preferred for this reason. If both ends are nicely approximated the passage of the instrument will sometimes be easy, but I prefer to pass it before the two preliminary urethral sutures are tied, because it can be directly inserted into the posterior end under the direction of the eye. The remaining sutures are then inserted and tied. Two or three fine superficial urethral sutures may then be inserted to give additional support.

The posterior end of the urethra having been exposed by dissection to the extent of at least one centimetre and a half

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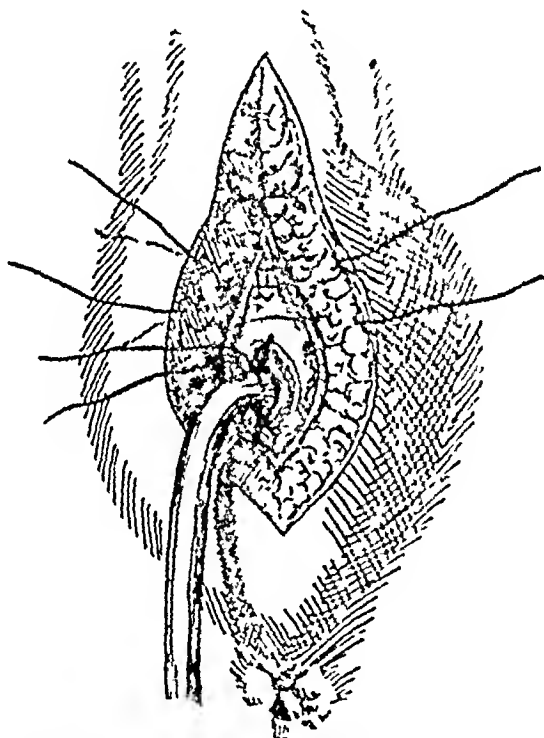
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instrument should be passed until the twelfth day, when cicatrization may be supposed to be complete

The deviation catheter may be removed on the tenth day and the patient allowed to urinate *per methrum*, but the canal must not, I repeat, be interfered with instrumentally. Micturition will take place mostly through the buttonhole, but within forty-eight hours after the catheter has been removed the urine will be voided by the methra, and the fistula will close in from five days to a week.

FIG 5



The urethra sutured and catheter inserted into bladder through buttonhole in bulbous portion

If there is a severe cystitis present at the time of the operation, it is well to continue the deviation longer, in some cases three weeks or a month

In closing, I would sum up by saying that suprapubic deviation is indicated in (1) impassable strictures requiring retrograde catheterization, (2) impassable strictures but seated far back, two centimetres in front of the membranous urethra. In all other cases deviation should be obtained by a urethral buttonhole as described

# OPERATIVE FIXATION AS A CAUSE OF DELAY IN UNION OF FRACTURES.\*

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THE great activity, developed in recent years, in the operative treatment of closed fractures, makes it desirable to report any instances of operative fixation that have been followed by unsatisfying symptoms or disastrous results. Many of us have for years been opening recent, closed fractures for the discovery of complicating lesions, for operative reduction, or for satisfactory fixation. My own advocacy of such measures began about 1885. Hence I should not be considered an unduly prejudiced critic of the present furore for operative uncovering of the ordinarily severe closed fractures of the tubular or long bones.

It seems to me, however, that the earnest advocacy of such radical procedure by especially expert and experienced operators has a tendency to do harm to surgical science and to encourage the assumption of unnecessary risks by the public. The situation resembles that of the period when hundreds of women were unnecessarily rendered sterile by oophorectomy for the so-called sclerotic ovary, others subjected to needless nephrorrhaphy for loose kidneys, and both sexes deprived of useful thyroid glands, because these operations were found to be comparatively free from fatal issue and because neither the docile patients nor the hasty surgeons knew the true physiological worth of the organs thus subjected to surgical insult. A similar illogical following of brilliant operative masters is now occurring in the domain of tonsillar pathology, and is fast approaching, one may fear, in the treatment of closed fractures of the bones of the extremities.

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\* Read before the Philadelphia Academy of Surgery, Dec 2, 1912

Operative surgery has a brilliant career, but its activities must be controlled by a logical mind, not too much given to dwelling on the conservatism of the past or so flushed with victory that it encourages running amuck through hospital wards.

I recently reported<sup>1</sup> two deaths following fixation of closed fractures of the femoral shaft with plates and screws. Dr. Joseph Ransohoff,<sup>2</sup> of Cincinnati, says that Babler in a late report of the St. Louis City Hospital mentions two deaths occurring out of 13 cases of simple (closed) fractures of the femur treated by plating. He himself knows of two other deaths after operative treatment of this injury. I, myself, have heard of one death other than mine occurring in Philadelphia under similar circumstances. This shows that operative fixation of fractures of the femur at least is not as innocuous a proceeding as some medical men seem willing to assume.

My present purpose is to seek information on the comparative rapidity of bony consolidation of fractures under non-operative and operative treatment. It will be conceded at once that to obtain a mathematical determination of this question, it would be necessary to apply both methods to the same number of fractures of the same character and severity, occurring in the same part of the skeleton, and treated under the same circumstances by the same surgeon. These conditions are manifestly unobtainable. I must, therefore, be content to give the statements, which I have obtained from recent surgical literature, bearing on the length of time required for the union of broken bones under these dissimilar methods of treatment.

My attention was called to the possibility of plating being a cause of delay in union by having under my care a young man in whom this contingency seemed to take place.

Mr. D. S. B., aged twenty-nine years, sustained on April 13, 1912, a closed fracture of the right tibia, a little below the middle of its shaft, and a double fracture of the fibular shaft of the same

leg, which also was closed. The injuries were due to striking his leg against that of another player in a game of baseball. His general health was good. A surgeon endeavored to set the fractured leg without anæsthesia, but was not successful. Then 15 pounds extension, made with an anklet and a pulley, was employed for several days. Ten days after the receipt of injury, an X-ray picture was taken showing a fracture of the tibia, which was almost transverse, and two adjacent fractures of the fibula. At this time an attempt was made under chloroform anæsthesia to reduce the fragments. This was unsuccessful.

Fourteen days after the accident the tibia was exposed by a longitudinal incision under ether anæsthesia, and a Lane plate about four inches long was applied with screws to the fibular aspect of the tibia. The reduction of the fracture was perfect. No fixation apparatus was used for the fibular breaks. A gypsum encasement was put upon the leg for external support. It covered the ankle-joint. I do not know whether it went above the knee. The external wound healed by first intention and without pain. The gypsum splint was split two weeks after its application.

Ten weeks and two days after the receipt of the fracture (June 24, 1912) he came to me walking on crutches, and with the leg still protected with the gypsum splint. The fibula had apparently united, but there still was marked anteroposterior mobility at the seat of the fracture of the tibia. There was no swelling as of tibial callus on the subcutaneous surface of the shin bone, and the apposition of its fragments was perfect. I treated him with calcium carbonate, gr v, and calcium lactophosphate, gr v, internally three times daily before meals, used the rubber bandage around his thigh for congesting the seat of fracture, supported the broken bone with a gypsum encasement, and had him walk on crutches and stay a good deal in the open air. This line of treatment I continued for six weeks (until August 5, 1912) without producing any special effect on the ununited tibia. He was quite anxious about his useless leg, but seemed in good health except for this worry. He was a rather free user of tobacco.

As sixteen weeks and two days had by this time elapsed without union of the major bone occurring, I advised removal of the Lane plate and inspection of the site of fracture. I ex-

pected to find muscle or fascia between the ends of the fragments, or that the tibia was held apart at the break by the plate or by the already united companion bone. My suggestion to the patient was that I would remove the plate and then perhaps re-fracture the fibula to gain close contact of the tibial fragments or insert a bone graft cut from the crest of the same tibia in the gap between its fragments.

The tibia was exposed by an incision in the old scar, the plate was found hidden, under fibrous tissue and a small boss of callus, on the fibular aspect of the tibia. The subcutaneous or inner surface of the tibia was smooth, showing no deformity and no elevation of callus under the periosteum where the line of fracture was situated. The screws were imbedded in the bone, but were readily removed. There was no pus about the plate or screws. There was, however, a slight darkening of the tissues and some softening of the structures in a few places where they were in contact with the metal. The plate was removed, as were all the screws. A few drill punctures were made into the bone ends and into the tissue between them. The wound was closed without drainage, and it healed promptly.

The leg was dressed with a gypsum encasement and in a few days the man was allowed to be up on crutches. The rubber bandage for engorging the limb was used for longer periods of the day than before, lime salts and tonics were given, he was sent to the seashore, and much was done to encourage him. His tobacco was limited.

When seen on November 30, 1912, which was exactly 33 weeks after the fracture occurred, he still had a slight antero-posterior movement of the tibia at the seat of the fracture. At this point there is a slight mound of callus, and the bone is nearly solid. The gypsum splint has been discarded for three weeks and he has not used the rubber bandage for a short time past. He still takes small doses of calcium carbonate and calcium lactophosphate. He uses a cane for walking outside his home, but in the house uses the leg without any support. He has been attending to his scholastic duties for about two months. He was ordered to wear the rubber bandage for an hour a day and to take a small amount of lime salts. He evidently soon will have firm and satisfactory cure of the fracture without deformity.

In looking for a cause of delayed union in this patient I came to the conclusion that it was not unlikely that the opening of the tissues to apply the fixation plate had something to do with the delay in solidification of the fracture of the larger bone. Slow union or non-union of a fracture from interposition of muscle or fascia is not unusual, but here my exploratory observation at the time I removed the plate showed that this was not the cause of the trouble in this instance. It is true that the patient was very much worried over his condition and was away from his family at the time the accident took place. He also was very anxious to obtain a rapid cure because of the necessary resumption of his teaching in the fall. All these facts have seemed to me scarcely a sufficient reason for the want of callus formation at the seat of the fracture of the tibia in a man so young and apparently so healthy. It is true that there were three fractures, the two in the fibula and the one in the tibia, to be united, the existence of which threw a little more responsibility upon the bone-making powers of the blood.

Upon looking over recent surgical literature, I have been struck with the number of surgeons who believe that the opening of a closed fracture, for the purpose of establishing an anatomical correction of a deformity, has a tendency, not to shorten but to lengthen the time of consolidation of the broken bone.

Some of the advocates of the operative treatment of fractures, and particularly, I think, Mr. Arbuthnot Lane, believe that opening the tissues to gain access to the seat of fracture does not delay the union of the broken bone. Mr. Lane, I think, states that anatomical reposition in the manner advocated by him is almost never followed by delayed union or non-union.

Dr. Thomas W. Huntington, of San Francisco, says that it is interesting to note that in practically all cases where anatomical reposition has been attempted, three things have been accomplished: rapid bony union, absence of deformity, and absence of pain.<sup>3</sup>

Huntington in another article printed in 1908<sup>4</sup> in speaking of fractures of the femoral shaft states that approximate anatomical reposition is essential to quick repair and ideal result. He also believes that a very large percentage of all cases of delayed or non-union can be attributed to faulty adjustment. These two writers represent, I think, the opinion which most of us held when, within recent years, the unusual activity in operative treatment of these lesions began. That broken bones should unite by first intention when the fragments were properly adjusted seemed in accord with what happened in wounds of the soft parts and was, therefore, accepted. Perhaps due weight was not given to the possible physiological differences in the repair of tissue in which the deposition of inorganic salts is required to complete the restitution of physiological function. It is also possible that our reasoning was faulty, because the proper distinction was not made between bad open fractures which notoriously require a long period of time for proper cure, and uncomplicated closed fractures.

Dr. William Darrach, of Roosevelt Hospital, New York, has had a wide experience in the operative treatment of fractures, and is an earnest advocate of the method in a large range of cases. He says in his paper<sup>5</sup> read before the American Medical Association and published in August of this year that his experience has been that firm union comes a little more slowly in fractures that have been opened.

Another similar opinion is given by Dr. Astley P. C. Ashhurst<sup>6</sup> in his article on the treatment of fractures of the forearm, in which he gives the notes of 52 cases treated without operation. He states that if in treating these fractures the surgeon will use "the eyes in the ends of his fingers, he will secure by conservative means quite as good, and in many cases a much better result than by operation, and in a shorter time." In another part of his paper he gives as his opinion that after operation the process of union often is slower than it would have been if no operation had been employed.

One of the advocates of the rather frequent necessity for direct fixation of fractures is Dr Leonaid Freeman, of Colorado. His statement is that it is certain that delayed union is more common after operation than when fractures are treated by ordinary means.<sup>7</sup>

In a later article published in 1911,<sup>8</sup> when discussing the operative procedure, Dr Freeman makes this statement "All this gives rise to two dangers—infection and delayed or non-union." In the same article, he continues "The tibia is one of the most frequent sites of delayed or non-union, and particularly is this true of fractures that have been operated upon and perhaps united by wires or bone plates. Fritz Koenig asserts that this is due to the removal of blood clots and tissue fragments, which are supposed to stimulate bony union, while others place the blame upon the foreign bodies introduced by the surgeons, but whatever the explanation may be, the fact remains." In the earlier article Dr Freeman says that this delay in union may occur when the periosteum has not been disturbed and when no wires are employed. This seems to indicate that he attributes the slowness of bony repair to the operative intervention itself without reference to foreign bodies being used or the periosteum being unduly disturbed. In another part of his earlier article he speaks of the delayed union after operative intervention being more frequent when fractures of the femur are so treated than those of the tibia, and attributes this more frequently delayed union to the necessary disturbance of the tissues in a deeper wound.

Probably this experience of Dr Freeman has something to do with his advocacy of subcutaneous fixation with long screws and an external clamp.

In an article in the *Journal of the American Medical Association* of October 21, 1911, Dr Edward Martin, of Philadelphia, asserts that "It is noteworthy that union is usually delayed, that the time of treatment is not materially shortened, that the results are not uniformly good. But taken as a whole, they are infinitely better than could possibly have been secured by other than operative means." He thinks "There



has seemed to be a relation between the size of the internal splint and the promptness of final union. In other words, we have felt that the less foreign matter we put into the wound the quicker it got well." The same writer in an article on the open treatment of transverse fracture of the femoral shaft printed last year<sup>9</sup> makes the statement that union is nearly always delayed, the delay being proportionate to the amount of stripping of the bone ends and trauma of the soft parts at the time of operation. He thinks that we have no evidence that the period of after-treatment, before complete, or what we call complete, restoration of function is accomplished, is materially shortened by plating.

These opinions of Dr. Martin are confirmed by his statement made in September of this year<sup>10</sup> that as a rule the presence of a plate (Lane plate), instead of stimulating osteogenesis between the broken bone ends, retards it.

This statement of Martin is quoted by Dr. F. H. Albee<sup>11</sup> in his paper on bone transplantation in the treatment of Pott's disease, club-feet and ununited fracture as a reason for advocating the use of bone grafts in non-union of fractures.

These writers are not alone in the belief that direct fixation may be a cause of delay in union. William Hessler<sup>12</sup> has written that it has been his experience to see union delayed weeks, even months, though he has never had a case of infection.

S. C. Plummer, of Chicago,<sup>13</sup> states that he has heard Dr. John B. Murphy express the opinion that union was slower when a Lane plate had been applied. Plummer says that this has also been his experience in some cases. Plummer, therefore, does not agree with the opinion of Mr. Lane, whom he quotes<sup>14</sup> as making the statement that operative treatment "shortens the duration of the period during which he (the patient) is incapacitated for work, since union is practically by first intention, and, consequently, very rapid and perfect."

I finally give the opinion of Joseph A. Blake,<sup>15</sup> of New York, on this subject, which is valuable, because Dr. Blake has been greatly interested in the operative treatment of fractures and

has written a good deal in its favor. In speaking of non-union after the operative treatment of broken bones, he says "The occurrence of non-union is not so very rare, even when the fragments have been maintained in end-to-end position by ordinary external splints. I have seen such results notably in the femur. I have also seen non-union occur when the femur had been wired. In these cases non-union has usually been attributed to the presence of the wire. When, however, the wire was changed for a plate which kept the fragments rigidly fixed, union resulted in spite of the presence of much more foreign material."

Many surgeons have probably seen this occurrence. I, myself, a good many years ago was unable to get union of an ununited fracture of the humerus by wiring, which another surgeon subsequently cured, I understood, by the insertion of a plate.

Blake further says that he has had three cases of mild infection after operations upon the femur in which there was a rather excessive production of callus. In these instances "union did not seem to be delayed, but even seemed to be accentuated." He makes the assertion that "mild infections apparently do not interfere with union, but, on the other hand, seem to stimulate the formation of callus." He maintains, however, that "Infections severe enough to cause necrosis of tissue manifestly will prevent union." He calls attention to the fact that he does not look upon infection of such operative wounds with satisfaction, for infection must be considered, he says, "the worst misfortune that can happen in operations for fractures."

Plummer, in commenting upon the fact that slight degrees of sepsis seem to hasten union of the broken bone, truly says that all agree that the one chief and overwhelming cause of failure in the operative fixation of broken bones is sepsis.

I have reported my own case of apparent interference with union by operative fixation with a plate to maintain coaptation of the fragments after a difficult reduction. I have also gone over the recently expressed opinions of surgeons doing

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# TREATMENT OF VOLKMANN'S CONTRACTURE

A REPORT OF TWO CASES WITH DESCRIPTION OF APPARATUS

BY EMORY G ALEXANDER, M D,

OF PHILADELPHIA,

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and the Mary J Drexel Home

NEARLY forty years have elapsed since Volkmann first described a peculiar contracture of the hand, which he believed due to an ischæmia of the muscles from a cutting off of the arterial blood supply. He believed that the usual cause was too tight bandaging in the treatment of fractures, but also stated that the condition might follow injury to the blood-vessels, compression, or cold.

Volkmann thought the condition to be the result of a myositis and not to a primary nerve involvement, basing his belief on the fact that the paralysis and contractures appeared almost simultaneously, while the contractures following nerve injury were delayed.

Many articles on this interesting subject have been written, but little, excepting the treatment, has been added to the causes, clinical description, and pathology, as described by Volkmann.

The pathology of Volkmann's contracture is still a mooted question. Many follow Volkmann and believe the condition to be a contracture myositis, others, that it is primarily muscular in origin, but that there is a secondary nerve involvement, and still others believe that the nerves are primarily at fault.

Thomas, of Boston, in an excellent article on this subject, read before the American Neurological Society, says that if the nerves are involved in producing the muscle changes it is in the terminal muscle branches and that this is of secondary importance, and that "the involvement of part of a muscle only by the connective-tissue formation with a good response

this kind of work. My intention has not been to discourage the election of direct fixation in fractures, which are difficult to reduce or hard to maintain in position after reduction. This contribution is rather a plea for caution against the enthusiastic adoption of this method of treatment as a routine means of dealing with closed fractures. The profession and the public should know that while it is a necessity in some cases and its adoption a question of judgment in other cases, there are many instances of simultaneous or closed fracture in which it is not needed. Good results can often be obtained, both as to anatomical restoration of the parts, good function and rapid cure, by external dressings guided by a thoughtful careful surgeon, who has a mechanical mind and anatomical knowledge. The operative treatment is particularly dangerous when adopted by novices in aseptic surgery, or in places where complete aseptic surroundings cannot be obtained.

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- <sup>3</sup>International Clinics, 21st Series, vol. III
- <sup>4</sup>ANNALS OF SURGERY, September, 1908
- <sup>5</sup>Journal American Medical Assoc., August 3, 1912
- <sup>6</sup>Am. Journ. of Med. Sciences, June, 1912 p. 843
- <sup>7</sup>Surgery, Gynecology and Obstetrics, Feb., 1909, p. 150
- <sup>8</sup>ANNALS OF SURGERY, September, 1911, p. 382
- <sup>9</sup>Surgery, Gynecology and Obstetrics, August, 1911
- <sup>10</sup>Surgery, Gynecology and Obstetrics, September, 1912
- <sup>11</sup>The Post-Graduate, November, 1912
- <sup>12</sup>Surgery, Gynecology and Obstetrics, August, 1911
- <sup>13</sup>Journal of Iowa State Medical Society, June, 1912
- <sup>14</sup>Surgery, Gynecology and Obstetrics, April, 1909 p. 311
- <sup>15</sup>Surgery, Gynecology and Obstetrics, April, 1912 p. 338

electricity, and massage One case was of short duration, the other had existed for several months

CASE I—A. W., female, age six years, was admitted to the Children's Hospital of the Mary J Drexel Home in February, 1912, with the following history

In June, 1911, the patient fell down a flight of stairs and sustained a T fracture of her right elbow The fracture was treated with an anterior right-angle splint The splint was too small, and when first applied was tightly bandaged to the arm and forearm This caused so much pain that the bandages had to be loosened The fracture was treated with this splint for six weeks, and on its removal, besides having a stiff elbow, it was noticed that the patient had a Volkmann's contracture The limitation of motion of the elbow rapidly improved, but the Volkmann's contracture grew steadily worse When seen by us the child showed a well-marked Volkmann's contracture of the right hand with atrophy of the muscles of the forearm, especially the flexors The small muscles of the hand also showed atrophy No accurate tests were made, but there was diminution of sensation in the hand The muscles were not tested for degeneration The circulation of the hand was impaired If the hand was flexed to a right angle the patient could extend the fingers

The case was treated on a splint, which I shall describe later, electricity and massage were given every other day, and the splint gradually extended At the end of twelve weeks the case was discharged from the hospital cured, with good supination and pronation of the forearm, flexion and extension of the wrist and fingers We heard from the patient a few days ago and no contractures have recurred

CASE II—H. S., male, age ten years, came to the Children's Hospital of the Mary J Drexel Home from a neighboring city with the following history

Five days before admission sustained a fracture in the neighborhood of the elbow-joint Reduction was attempted and an anterior right-angle splint applied The patient stated that the splint was tightly bandaged to his arm As a result of the tight bandaging the fingers became blue, cold, and numb The patient suffered intensely the first night following the accident and gained no relief until the dressings were removed On admission

to the remaining portion of the muscle to electrical stimulation," shows "that the nerve involvement in the primary process is not a necessary factor" The same author also calls attention to the frequent secondary involvement of nerve trunks in connective-tissue overgrowth To this involvement Thomas thinks are due the disturbance of sensation, the reaction of degeneration and the atrophy of the hand muscles, as are seen in some cases of Volkmann's contracture

The treatment for the contracture first recommended by Volkmann consisted in stretching the contracted muscles under an anæsthetic The other methods that have been recommended consist in the gradual stretching of the muscles by means of a splint and by operation

The operations devised are, freeing the nerves from connective-tissue formation, myotomy, and tendon lengthening, either by operating directly upon the tendons, or indirectly, by removing a portion of the bones of the forearm

Volkmann believed his method applicable to recent cases, but in old cases with marked cicatricial changes there was danger of fracturing the bones or rupturing the tendons In direct tendon lengthening, the disadvantages are the danger of infection, the length of time required to perform the operation, and the adhesions that sometimes form around the tendons The deformity it produces, the weakening of the extensor muscles, and the liability of infection or non-union must be thought of before undertaking bone resection Freeing the nerves and myotomy have both been practised with some success Jones has discarded all operative measures and relies entirely upon "mechanical and manipulation routine" His reasons for so doing are that operative measures are "hazardous and inadequate," as any open operation must be performed through tissues deficient in circulation and usually cicatricial He also states that after operation "almost immediate mechanical strain" is necessary to correct the deformity

The following two cases were treated by mechanical means

electricity, and massage One case was of short duration, the other had existed for several months

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to the Drexel Home, five days after the accident, the arm and forearm were greatly swollen. The forearm was dusky, cold, and showed numerous blebs. On the flexor surface of the forearm, just below the elbow, was a large superficial ulcer. An X-ray examination showed an unreduced supracondylar fracture of the left humerus with the usual displacement of the fragments. All dressings were removed, the arm elevated and placed on a pillow, and hot antiseptic dressings applied. The circulation gradually improved, and at the end of a week, all fear of gangrene having passed, an anæsthetic was administered and an attempt made to reduce the fracture and the arm placed in the Jones position.

The patient remained in the hospital one month and was then discharged and referred to the dispensary. At the time of discharge he showed no sign of a contracture. About two weeks after leaving the hospital, and six weeks after the injury, it was noticed that he had a Volkmann's contracture. As the patient was not under my care when first treated in the dispensary, I do not know the muscle and nerve condition at that time other than the nerve involvement was very marked, as the patient told me that he accidentally placed his hand on a hot stove and received a severe burn without feeling any pain.

This case was treated as Case I, and in about three months' time was able to flex and extend the fingers and wrist. Although the patient has good wrist and finger motion, he still shows atrophy of the muscles of the forearm and hand. Sensation in the hand is apparently normal (Figs. 1 and 2).

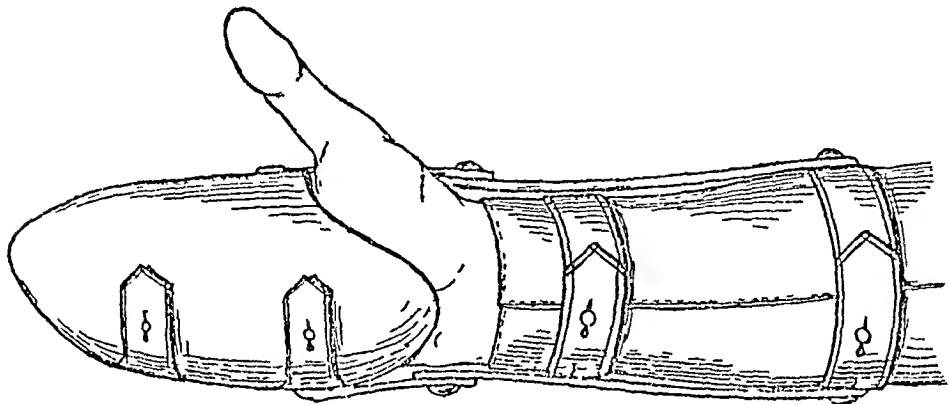
The only difficulty encountered in the treatment of these two cases was superficial pressure ulceration of the finger tips. This, I am sure, was due to faulty management and trying to produce too rapid an extension of the fingers. This difficulty we overcame by placing pads under the finger tips and "making haste slowly" with the extension.

Jones has noticed that, when the contracture has improved to such a degree as to permit hyperextension of the hand without a tendency to recurrence, the circulation will be found, as a rule, to have improved. He also claims that when the nerves are involved relaxation of the contracture is frequently accompanied by nerve improvement.

The apparatus used in treating the two cases reported consists of two parts

Part 1 consists of a leather casing encircling the lower half of the forearm. The casing is reinforced on each side (radial

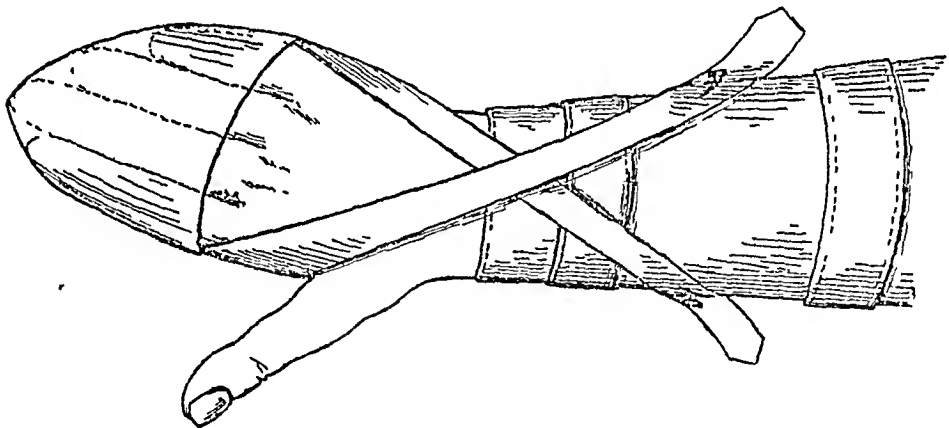
FIG 1



Palmar view

and ulnar) by a steel bar. A semicircular bar at the upper end extends around the flexor surface from the radial to the ulnar bar. The casing is buckled on the extensor side of the forearm.

FIG 2



Dorsal view

Part 2. A plate covered with leather is fitted to the palm of the hand and fingers. Extending from one side of the plate to the other, on the dorsal aspect, is a wide leather strap to hold the fingers straight and in position. Two bars attached in front on either side of the plate pass backward, the one on the radial side arching much more than the ulnar one, to join

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# INFECTIONS OF THE HAND

A REVIEW OF 90 CASES

BY LEROY W. HOON, M D.,

AND

GEORGE J ROSS, M D.,  
OF PHILADELPHIA

THIS study is based upon all the cases of infection of the hand treated in the German Hospital Surgical Dispensary from April 1, 1912, to October 1, 1912. Ninety cases in all were treated during these six months, and it is of incidental interest to note that during this period only five cases of infection of the foot presented themselves for treatment.

In the main we followed closely the anatomy, diagnosis, and treatment as urged by Allen B. Kanavel, of Chicago, in his most excellent book, "Infections of the Hand." This line of treatment was a radical departure in several respects from our former treatment, but as the first few cases so treated gave such splendid results, we have been using Kanavel's method or a modification ever since.

The less severe cases will be taken up first, as we wish to reserve the deep infections for more emphatic discussion. Under the less severe infections come felons, paronychiæ, carbuncles, furuncles, infected blisters and cuts, and other superficial infections.

*Felons (Nine Cases)* —By "felon" we mean an infection occurring within the closed connective-tissue space which exists in the pad over the palmar surface of the distal phalanx of the thumb and fingers. Seven of these cases were seen before pressure had shut off the vessels supplying the diaphysis of the distal phalanx and thereby caused osteoperiostitis. These cases were at once arrested, and made rapid and complete recovery by making a deep lateral incision, opening the periosteum to evacuate the pus, and dressing the part with hot, wet

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\* Read before the Philadelphia Academy of Surgery, December 2, 1912

4 per cent boric dressings for a day or two. Two of the cases already had osteoperiostitis of the diaphysis of the phalanx when first seen. The epiphysis was not involved in either case and immediate and complete removal of the diaphysis was practised. Both cases recovered with the joint intact and had a functioning stump. The Klapp suction cup and baking hastened the cure in one case. Nitrous oxide anaesthesia was used in all cases.

*Paronychia (Four Cases)*—These cases were all treated as advised by Kanavel, *i.e.*, under nitrous oxide anaesthesia a longitudinal incision was made along the lateral edge of the nail, going back as far as the sulcus and being especially careful not to cut the nail bed or overhanging cuticle. The eponychium was then pushed back, point of scissors inserted beneath the detached edge of the nail, and as much of the nail as had been lifted from the nail bed by pus was snipped off. Subsequent dressings of hot, wet boric for two or three days, followed by dry dressings, rapidly cleared up all four cases.

*Carbuncles, Furuncles, Infected Blisters and Cuts, with other Superficial Infections (Fifty-four Cases)*—Carbuncles and furuncles were treated under nitrous oxide anaesthesia by crucial incisions extending beyond the indurated area, followed by thorough undercutting of all four flaps. Squeezing of pus outward was avoided, and for two or three days following wet boric dressings were used. Recovery was hastened by the suction cup in several cases. Necrosis of the flaps was conspicuously absent and thereby less scarring resulted. Perfect drainage occurred. The infected blisters and cuts were opened where needed, and hot, wet boric dressings applied until the discharge began to thin, when iodine and dry dressings were used.

Every one of these 54 cases was saved from becoming a deeper infection by these simple means.

Having disposed of these less serious cases, we now approach the deep infections of the hand—those hidden struggles between microbe and body protoplasm deep in fascial space or tendon sheath, the prize of battle being a pliant, useful hand, or the pathetically twisted "claw hand" so often seen.

Twenty-three cases of this nature were treated, and in comparison with the usual outcome in such cases the end results were most gratifying. An outline of the anatomy and operative incisions advocated by Kanavel should precede any discussion of these cases.

#### ANATOMY

The anatomical knowledge needed is not so much a knowledge of the attachments of the palmar fascia and superficial transverse ligament, palmar arterial arches, and anterior annular ligament as it is an understanding of the fascial spaces and flexor tendon sheaths.

Pus may collect in the following six fascial spaces:

- 1 Dorsal subcutaneous, an extensive area of loose tissue over the extensor tendons of the back of the hand.

- 2 Dorsal subaponeurotic space, lying between the extensor tendons and the metacarpal bones.

- 3 The hypothenar space, an unimportant intermuscular space occupying the hypothenar eminence. Pus located here would not burrow into deeper spaces, but would spread to the surface.

- 4 The thenar space, an important space in the thenar eminence. It lies entirely to the radial side of the middle metacarpal and upon the palmar side of the adductor transversus muscle.

- 5 The middle palmar space, another important space, lying between the metacarpals and deep flexor tendons and extending from the middle metacarpal bone to the fifth metacarpal, and having extensions along the three outer lumbricals into the webs.

- 6 The web space, a subcutaneous space in the finger webs.

Besides these fascial spaces, the following flexor tendon sheaths are of the utmost importance:

- 1 The tendon sheaths of the index, middle, and ring fingers, extending from the middle of the distal phalanx to a line joining the ulnar end of the distal palmar crease and the radial end of the proximal palmar crease (Kanavel's line).

- 2 The tendon sheath of the flexor longus pollicis and



radial bursa. This extends from the base of the distal phalanx and when connected to the radial bursa (as it is in 19 out of 20 cases, Poirier) it extends to the lower end of the radius.

3 The tendon sheath of the little finger and the ulnar bursa, when connected (as in 50 per cent of cases) extends from the distal phalanx of the little finger to the lower end of the ulna.

#### INCISIONS USED IN OPENING FASCIAL SPACES AND TENDON SHEATHS

These incisions offer the most intelligent approach to deep pus pockets with the best drainage and least amount of after-scarring:

1 The tendon sheaths along the fingers are opened laterally along the proximal and middle phalanges, if sufficient drainage is not gained by these incisions, we may open laterally opposite the proximal interphalangeal joint as well.

2. The thenar tendon sheath may be split up to a thumb's breadth distal to the anterior annular ligament so as to avoid cutting the motor nerve going to the thenar eminence and thereby destroying apposition of the thumb.

3 The hypothenar tendon sheath may be cut from the base of the little finger up to the anterior annular ligament.

4 The ulnar or radial bursæ above the wrist. One incision is made on the ulnar side  $1\frac{1}{2}$  inches above the tip of the ulna and extending down to and across the flexor surface of the ulna. A closed hæmostat is now thrust across both ulna and radius and pronator quadratus, and a counter-incision made upon the radial side of the wrist, where the hæmostat shows beneath the skin. These incisions should both be enlarged to  $1\frac{1}{2}$  inches up the forearm.

5 The middle palmar space. This is opened by cutting into the lumbrical canals, preferably choosing the one between the middle and ring fingers. This incision may be carried  $1\frac{1}{2}$  thumb breadths up the palm and a hæmostat thrust beneath the deep flexors into the middle palmar space (Besley).

6 Combined opening of the middle palmar and thenar space. A hæmostat is pushed through the incision just de-

scribed for opening the middle palmar space, pushed across the middle metacarpal bone through the thin partition between this space and the thenar space, and on across the adductor transversus muscle to the dorsum between the first and second metacarpals at about the middle of the second metacarpal. A counter-incision is made here and a rubber dam diam left in for about 18 hours as a rule.

7 Combined opening of the middle palmar space and subaponeurotic space. In the space between the middle and ring metacarpals where the middle palmar crease crosses, an incision is made and a hæmostat thrust through to the dorsum, where a counter-incision is made.

8 The thenar space. This may be opened by one incision through the dorsum on the radial side of the second metacarpal opposite the middle of that bone and on a level with its flexor surface. A hæmostat is then thrust through into the thenar space, being careful not to go beyond the middle metacarpal. No counter-opening on the palm is needed.

9 The subaponeurotic space is drained by adequate incision upon the dorsum over the interosseous spaces.

10 The hypothenar space is opened as any minor localized infection by direct incision.

#### DISCUSSION OF THE CASES OF DEEP INFECTION TREATED

During the six months' period, 23 cases of this nature presented themselves for treatment, having infections classified as follows:

Tendon sheath infections	10
Middle palmar space infections	11
Thenar space infections	4
Collar button abscess at web	4
Dorsal subcutaneous infections	2
Dorsal subaponeurotic infections	2
Hypothenar space infections	1

The average age of these cases was 28 years, 19 were male and 4 female. Regarding cause, 9 arose from infected cuts, etc., 5 from infected blisters, 1 from a bruise, and 8

from unknown cause Six days was the average elapsed time between onset and first visit to the dispensary The most prominent symptoms were pain, disability, and loss of sleep Constitutional symptoms as chill, fever, and loss of appetite were present in about one-half of cases

In diagnosing the location of pus, the most valuable aids were as follows:

- 1 In the frog felons or collar button abscess, web tenderness and redness, and a semiflexed position of the adjacent fingers

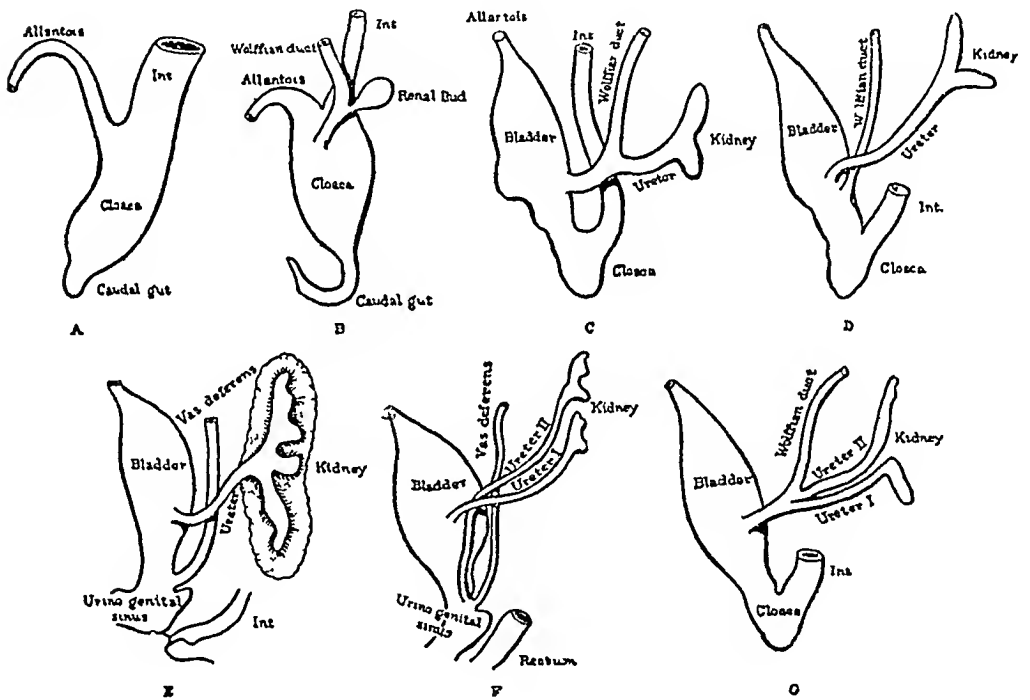
- 2 In the tendon sheath infections, exquisite and unmistakable tenderness over the course of the sheath, a flexed position of the finger, and great pain upon attempting to passively extend the finger, were the three cardinal signs Necrosis of tendon had already occurred in five cases, and necrosis of bone in three cases

- 3 In the fascial space infections, the chief signs were localized tenderness over the thenar or middle palmar space, induration, flexion of the fingers with painful extension, loss of concavity of the palm with slight convexity in middle palmar infection, and ballooning of the thenar eminence with pushing outward of the first metacarpal in thenar space infections Edema and redness of the back of the hand was an ever-present feature, but tenderness was much less than that of the palmar surface, and in only three cases was pus present in the dorsum, this being diagnosed chiefly by induration

As to treatment of these 23 cases, the incisions recommended by Kanavel were faithfully followed, with one exception, which will be discussed later Nitrous oxide and oxygen anaesthesia was sufficient in 18 cases, ether being used in five cases Preliminary bandaging of the forearm and arm above the operative field with elastic rubber bandages was tried in the first two cases Kanavel advises this procedure in order to render the operative area bloodless and by subsequent gradual loosening over a period of about 18 hours to gradually allow the newly liberated toxins to enter the circulation, and thereby give the system a chance to form defensive products After carefully observing the effect upon these two cases, this pro-

The kidney gradually ascends to the lower dorsal and upper lumbar region. As it ascends it passes and receives its blood supply in succession from the numerous arteries previously developed from the aorta to nourish the mesonephros. As many as five of the branches may be carrying blood to the kidney at once. As the kidney ascends and higher arteries become attached to it the lower ones separate from it. When it reaches its final position one of the arteries enlarges and becomes the permanent renal supply. This is usually the upper

FIG 2



From Dr George S Huntington's paper on "The Genetic Interpretation and Surgical Significance of Some Variations of the Genito-Urinary Tract"

member of the lower or the lower member of the middle mesonephric group. Thus in anomalies of position the vessels may arise from the sacralis media, from the common iliac, the inferior mesenteric or along the line of the aorta. If irregularly situated they are usually increased in number. In the division of the kidney into upper and lower portions with separate pelves the division of the vessels permits of the removal of one-half of the organ without injury to the other half. In horseshoe kidney, however, Robinson<sup>1</sup> found 10 out of 60 cases reported with but a single artery branching to

successfully built up treatment for simple or grave infections of these parts

3 For the 23 cases of deep infection, the incisions recommended by Kanavel resulted in the most perfect restoration of function with the least after-scarring

4 An utter disregard of the so-called danger of opening up uninfected areas in the hunt for pus did not result in harm. Incisions into doubtful areas were always made before opening into obviously pus-filled areas. In our future cases we intend to open up areas in which we cannot say definitely whether there is or is not pus, using the same incision as should be employed for opening up obviously infected pockets

5 Rendering the operative field bloodless before operation and subsequent gradual release of the bandage is an unnecessary procedure

6 Conservative irrigation did no harm, but just as good or better results were obtained by merely washing off what pus could be brought out by very gentle pressure

7 Bending or extending of the fingers in a day or so after operation was found to be entirely free from danger of spreading the infection and of paramount value to the patient in securing for him an afterwards useful hand

8 Incisions upon the back of the hand are rarely needed. The redness and œdema commonly present upon the dorsum in these cases is extremely dangerous because it often leads the uncertain practitioner to cut into pus-free areas, and then, finding no pus, to adopt one of the fatal policies of poulticing or waiting until the abscess shall "come to a head." Meanwhile the increasing infection may cause bone or tendon necrosis with crippling, that no amount of carefully made incision or faithful post-operative massage will wipe out

9 Hot boric dressings, the dorsal splint, and flat rubber dam drains (never tubing) as used above form an indispensable trio

10 All cases treated as we have described recovered perfect function excepting those few cases where necrosis of bone or tendon was present when the patient was first seen

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting held December 2, 1912*

DR GWILYM G DAVIS, President, in the Chair

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### INFECTIONS OF THE HAND

DR LEROY W HOON and DR GEORGE J ROSS presented a paper entitled "Review of Ninety Cases of Infections of the Hand," and exhibited a number of patients For this paper see page 561

### APPARATUS FOR THE TREATMENT OF VOLKMANN'S CONTRACTURE

DR EMORY G ALEXANDER read a paper with this title, and presented the apparatus described See page 555

DR GWILYM G DAVIS reported two cases to illustrate the method of treatment adopted He stated in preliminary that as to the etiology, the relative part played by the nerves and muscles is a matter of dispute In his opinion the muscles are probably more affected than the nerves, although both may be involved In many of these cases, the site of probable lesion is indicated by a scar on the forearm, both cases here reported had such scars They are usually situated lower than the point of entrance of the nerve into the muscle, hence the latter escaped injury The involvement of the nerves in these cases is not before they enter the forearm muscle, but of those nerves which lie between the muscles and tendons, and muscular disturbances due to such involvement are shown by atrophy and paralysis of the intrinsic muscles of the hand and not of those muscles which arise high up in the forearm The nerves are apt to be involved only when all the adjacent muscles and tendons are matted together

Injuries to the nerves in the region of the elbow will however

produce muscular contractions which bear some resemblance to that produced by Volkmann's palsy, but the nerve lesion is more likely to manifest itself in the claw hand of Duchenne, while the muscular lesion exhibits a flexed wrist and contraction of most of the flexors of the fingers. The difference in the appearance of the hand and fingers in the two conditions is characteristic and is evidence of a nerve lesion as being the cause of one and the muscle lesion as being the cause of the other. As has, however, been stated there is undoubted nerve involvement in some of the true ischemic cases.

In the treatment of these cases, Mr. Jones, of Liverpool, strongly advises persistent stretching, and his results show that very much can be accomplished by that method of treatment. It is a long and tedious undertaking, which is not always feasible to carry out. The cases here given will show what has been accomplished by tendon lengthening. Even resection of both bones of the forearm will in some cases add greatly to the use of the member.

CASE I.—A boy, aged 11 years, had fractured his forearm five years previously. On the second day after the injury the bones came through the skin and were replaced under ether and the arm put up in splints. The contraction of the hand and fingers was said to have begun while the splints were still on, and now the contraction of the hand and fingers is very marked and they are almost entirely useless. This boy was treated persistently for two or three years with splints and apparatus made by his father, who is a skilful instrument maker.

An incision about three inches long was made down the ulnar side of the forearm, extending just above the pisiform bone. To this was added a transverse one directly across the wrist to the radial side. This flap was then raised and the tendons exposed. The palmaris longus, flexor carpi radialis, and the superficial and deep flexor tendons of the four fingers, ten tendons in all, were then cut and lengthened about half an inch, enough to allow the finger to be straightened. The median and ulnar nerves were not much involved. The tendons were then separated as much as possible by means of the adjacent fat and connective tissue, and the wound closed without drainage. Healing was uneventful. It is now five years since the operation and the patient is working in a grocery store and uses his hand quite well. When last seen, about a year after the operation, the result was almost perfect.

Now, after the lapse of four years, there seems to be a small amount of contraction again present, but still the hand is a very good and useful one

CASE II —This was a boy aged 7 years. He broke his forearm twice, two months apart, and the contraction was noticed after the second break as soon as the splints were removed. He had marked deformity with the hand firmly flexed on the forearm at a right angle and the fingers strongly contracted. He applied for treatment about five months after the last injury. This boy came from a distance and it was practically impossible to give him the necessary attention if simply stretching was to be employed, and in view of the satisfactory result of the previous case and the difficulties experienced in carrying out the stretching treatment it was decided to operate. In this case a median incision was made and the sublime and deep flexor tendons of the index, middle, and ring fingers were divided and lengthened sufficiently to allow them to come out straight. Fine silk was used to unite the divided tendons. In two weeks the plaster cast was removed and a sinus was found in the line of the incision which had been made through a scar which was present. A couple of pieces of fine silk came out and the wound after several weeks finally closed. Despite this occurrence the result was almost a perfect one, and now, one year after the operation, extension is perfect, but the fingers when voluntarily flexed do not quite touch the palm. He is using the hand well and is learning to write with it.

In both of these cases, when the proximal and middle phalanges are held firmly, the distal phalanges of each of the fingers operated on can be individually flexed, thus showing that adhesion between the superficial and deep flexor tendons is not present. Operation is not advised in all cases, but only in those in which for any reason the conservative methods of treatment are considered unsuitable.

DR FRANCIS T STEWART said that he had treated one case of this condition like Dr Davis, and although he secured vast improvement it was not nearly so great as in the cases reported by Dr Davis. There is one objection to an apparatus of the kind which Dr Alexander has shown. It provides the very condition that, in the first place, originated the contracture, that is, constant pressure. In one case he had ulceration as a result of this pressure. The pathology of Volkmann's contracture is not by any



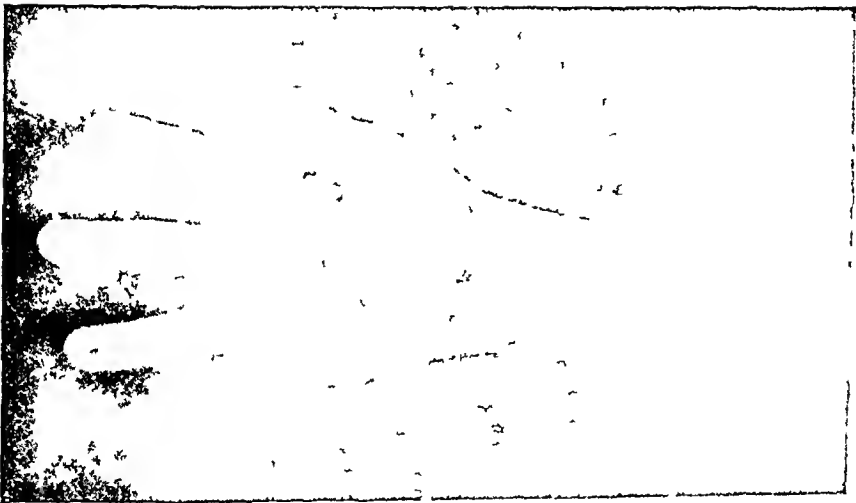
means clean. It is of some importance from a medico-legal standpoint to know that a few cases do not follow the application of a bandage, but result from a simple contusion. These contractures have more than one point in common with the contractures of the sternomastoid, where a bandage is almost never applied. The ischæmic theory has always seemed to him to be unsatisfactory. It may be that the condition is due to infiltration of the muscle with blood, and that this induces inflammation and subsequently fibrous overgrowth. This condition occurs almost entirely in children, very few patients are more than 12 or 15 years of age. Perhaps it is because the muscular tissue of adults is tougher than that of children.

DR JOHN H. JOYSON referred to a case reported here a year or two ago, in which he operated by lengthening the tendons of the muscles, but improvement has not been very marked. The condition was a very advanced one, the degeneration of the muscles amounting to complete alteration of the normal appearance of the muscle tissue. The muscles were yellow and brittle in appearance, and it seemed impossible to get any recovery of contractile joints. The nerves also showed marked alteration. They looked as if pinched between the contracting muscle fibres and were markedly atrophied for two or three inches.

DR JOHN H. GIBBOY said that he had seen a case of Volkmann's contracture following the placing of the arm in Jones's position where no bandage whatever was applied about the arm. He saw the patient when the accident occurred and placed the arm in this position, and did not see it again for some time. A number of weeks later the child had a Volkmann's contracture. It was due to swelling, the arm not being brought down as it should have been.

DR DAVIS remarked, apropos of the cause as to whether it is nervous or muscular, that in a good many of these cases there is an injury visible on the forearm, and the cicatrix in most of those that he had seen had been below the entrance of the nerve into the muscle, if, however, the nerves have been injured at the site of the injury of soft parts, the injury will show itself lower down, not only in disturbance in sensation but in the paralysis and atrophy of the intrinsic hand muscles. In a good many of these cases the hand-muscles do not appear to be atrophied, and

FIG 5



Case II After operation



the affection of the nerves may be due to their inclusion in the inflammatory process and the exudate which occurs after the injury. An interesting question is as to the treatment which shall be adopted in these cases in which a trial by stretching has been made and has failed. What shall be done after that? and on that point his two cases show what may be accomplished by tendon lengthening. In the small boy the result is almost perfect. In the older boy who had the deformity for five years, although he has not an absolutely perfect result, yet the hand is very useful and shows that a great deal can be done by operative means. Not much has been said about resection of the bones for this condition, but even that at times will be much better than leaving the cases alone.

DR EMORY G. ALEXANDER (in closing) remarked, as to Dr Stewart's criticism, that the apparatus is apt to produce the same conditions that cause a Volkmann's contracture. The pressure exerted by the apparatus is not constricting, therefore it does not cut off the circulation. The worst that can happen by improper use of the splint is superficial ulceration of the finger tips. There is no constriction of the forearm and the slight pressure exerted by the semicircular bar is not sufficient to do any harm.

As to the cause of the contracture, Volkmann thought that venous stasis played some part in causing or hastening the contracture. The fact that the condition has followed injury to blood-vessel, embolism, and constriction by an Esmarch band seems to prove that it is ischæmic in origin. Although attempts to produce the condition experimentally have not been successful, it may be possible that other causes than ischæmia, either combined with or the result of circulatory disturbances, are associated in producing the contracture.

It is of interest to note that all of the cases reported at the meeting give a history of too tight bandaging. A very famous American surgeon claims that Volkmann's contracture is a "surgeon's lesion." While he did not agree with such a broad assertion, certainly in the majority of instances the contracture could be prevented if proper care were exercised in the application of constricting dressings in the treatment of fractures in the neighborhood of elbow-joints.

A very important advantage gained by mechanical treatment, according to Jones, is that the structures are stretched in the order of their tension, and that the deep structures which are impossible to divide at operations may thus be elongated.

#### ARTERIOVENOUS ANEURISM TREATED BY ANGIORRHAPHY

DR FRANCIS T STEWART presented a boy, aged 7 years, who was admitted to the Pennsylvania Hospital, Nov 27 1911. Four years before this date he was circumcised by his physician. During the operation the knife was laid on the left groin, and as the patient was not completely relaxed by the anæsthetic he suddenly flexed his left thigh, impaling it on the knife. This was followed by a furious hemorrhage, which was controlled by enlarging the wound and applying ligatures. It was thought at the time that the femoral artery had been included in one of these ligatures. About one month after the injury a soft systolic murmur was noticed over the right heart, and later distinct enlargement of the heart was detected.

On admission to the hospital there was a scar about the middle of the anterior surface of the left thigh, and over this point a continuous thrill could be felt and a continuous bruit heard, the latter being transmitted down the femoral vessels as far as the knee and up as far as Poupart's ligament. Both thrill and bruit were reinforced at each arterial systole, and both ceased when firm compression was made over the scar or over the artery above the scar, but this compression did not seem to have any influence on the cardiac murmur. There was no appreciable difference between the pulsations in the right and the left tibial arteries. The entire lower extremity was bluish in appearance, owing to the large number of dilated venules that ramified through and beneath the skin. In none of these venules could pulsation be demonstrated, there were no large veins. The left leg was one inch longer than the right and one-half inch greater in circumference, but there was no œdema.

Under ether anæsthesia the femoral vessels were exposed above the scar and then traced downward. No tourniquet was applied, and many ligatures were needed to check the bleeding from the dilated veins. The vessels were adherent for about one-half inch, and there was no sign of a sac between them.

After an assistant had grasped the artery and the vein on each side of the adherent point the vessels were separated with a sharp knife and the opening in each, which measured about one-eighth of an inch in diameter, closed with sutures of fine silk. A flap of the vastus internus was then passed around the artery so as to form a canal for it and separate it from the vein. The muscles, the fascia, and the skin were next closed, without drainage, the limb placed on a splint, and a tourniquet applied loosely to the root of the thigh, so that if bleeding should occur the nurse could at once control it. The pulse in the foot reappeared, full volume, as soon as the blood current was turned on, and continued undiminished as long as the patient was under observation. The murmur over the right heart could no longer be heard after the operation, and the heart diminished considerably in size before the patient was discharged, Dec 8, 1911, 10 days after the operation. The only unpleasant feature in the case was a small stitch abscess at the upper angle of the wound.

Dr Stewart remarked that, as far as he was aware, attention had not been directed to the possible influence of an arteriovenous aneurism on the cardiac muscle, although one can readily understand how the right heart might dilate under the strain of the large amount of blood delivered to it under high pressure and with increased velocity, the strain being proportionate to the size of the involved vessels, to their proximity to the heart, and to the size and directness of the orifice of communication between the artery and the vein. In a case of arteriovenous aneurism of the subclavian vessels which he had the opportunity of examining recently, thanks to Dr Gibbon, under whose care the patient was admitted to the Pennsylvania Hospital, another factor increasing the strain on the heart was found. The veins of the upper extremity were thrombosed, and almost all the blood from the artery was turned back into the right heart, which was dilated. The aneurismal bruit was transmitted to the heart and along the pulmonary arteries, but when the aneurism was compressed no murmur could be heard over the heart. In the present case the cardiac murmur was apparently due to dilatation, since it subsided promptly after operation. If it had been transmitted from the aneurism it would have been heard over the abdomen, would have ceased when compression was made over the aneurism, and would not have been punctually systolic,

but post-systolic, because of the time necessarily elapsing between the contraction of the heart, the production of the murmur in the aneurism, and its propagation back to the heart. That it might have been intermittent and still due solely to the aneurism may be possible, since the weaker portion of the murmur might have been lost in the journey from the middle of the thigh to the heart.

Increase in the length of the limb has occurred in other cases (Franz, Cordonnier), and appears easy to explain, until one reads, as in Brindejone's case, that the limbs may be shorter and thinner than normal. Perhaps the size of the orifice of communication may have some influence on the growth of the limb. If it is small, as in this case, the arterial current is not diverted completely, hence the arteries below the fistula do not atrophy, but continue to irrigate the extremity with almost a normal quantity of pure blood. Further, the amount of arterial blood diverted may be just enough to enrich the venous current without seriously obstructing it. In such an event, which is well illustrated by this case, the circulation would remain active and there would be little or no œdema. If, on the contrary, the abnormal opening were very large, practically all of the arterial blood would pass into the vein, because of the lower pressure on the venous side of the circulatory apparatus, and most of this blood would be hurried directly back to the heart through the central segment of the vein, while the rest would distend the peripheral segment and prevent the return flow of the venous current, in addition the arteries distal to the aneurism would shrink and there would be passive congestion, œdema, and atrophy. In some cases, of course, the malnutrition may be augmented by atheroma, thrombosis, injury to the nerves, destruction of the collateral vessels, cardiac disease, or some debilitating malady of a general nature.

As to the treatment separation of the vessels, with excision of the sac, if such there be, and suture of the opening in the artery and in the vein is the ideal method in all cases in which the major vessels are involved and in which this operation is possible. Extirpation of the aneurism, after ligation of both artery and vein above and below, is the only rival of aneuriorrhaphy, and it must be confessed is a formidable rival, since it precludes recurrence, and, contrary to what one would expect

cedure was abandoned as an unnecessary elaboration of technic, no deterioration of results being noted in the other cases. Irrigation of the infected areas after incision was also abandoned after using it in eight cases, and a rigid avoidance of any forcible squeezing or attempts to milk pus out of deep areas was practised in all cases. If adequate incision was made and wet hot boric dressings applied until the parts were draining freely, we found that the subsequent profuse and at first almost alarming discharge of thick clotted pus so moistened the edges of the incisions leading to the pus pockets as to preclude any danger of these incisions glueing shut.

In cases where tendon sheaths had been incised, the hand and fingers were dressed in extension with a wooden dorsal splint until all danger of tendon prolapse was past.

Passive motion of the fingers and hand was started on an average upon the second day after operation, and no extension of infection occurred from this practice. Exploratory incisions into areas which proved to be free from infection were made in seven of the cases, only one of these subsequently becoming infected—this case cleared up long before the original infection and did no ultimate harm.

Hot boric dressings were kept up on an average three days after operation, and were then discarded for dry dressing. Secondary operation was required in nine cases and secondary arterial hemorrhage (from a digital artery) occurred in only one case. Perfect restoration of function was secured in 18 cases and partial restoration in five cases, these latter cases already having developed bone or tendon necrosis before applying for treatment.

#### RÉSUMÉ

In the 90 cases studied we wish to emphasize these points:

1. The 67 cases of simpler infection were all saved from becoming serious infections by the simple treatment outlined above.

2. The beautifully simple anatomy of the hand and forearm in relation to infective processes as emphasized by Kana-vel forms an amply sufficient foundation upon which can be



TABLE OF CONSERVATIVE OPERATIONS FOR ARTERIOVENOUS ANEURISM

Name of operator	Date of operation	Vessels	Age of patient	Cause.	Time between accident and operation	Operation	Result	Pulse
1 Veau	1906	Axillary	15	Stab	2 months	Double ligation of artery, suture of vein	Cure	?
2 Marchant	1898	Brachial	?	Stab	2 months	Suture of artery and vein	Cure	Reappeared in 1 $\frac{1}{4}$ of hour then grew fainter
3 Van Imshoort	1903	Brachial	26	Stab	?	Ligation of canal between artery and vein, ligation of vein	Cure	?
4 Protherat	1907	Brachial	19	Stab	?	Suture of artery and vein	Cure	?
5 Doyen	1908	Brachial	11	?	?	Suture of artery and vein	Cure	?
6 Auvray	1909	Common femoral	15	Stab	7 months	Suture of artery, lateral ligation of vein	Cure	Persistent
7 Montaz	1893	Superficial femoral	16	?	?	Double ligation of artery, lateral ligation of vein	Cure	?
8 Garré	1904	Superficial femoral	16	Stab	10 years	Suture of artery, double ligation of vein	Cure	?
9 Gessner	1906	Superficial femoral	22	Gunshot	12 years	Inter-arterial suture of opening into artery and both ends of vein (re tortive endo aneurysmorrhaphy)	Cure	Persistent
10 Westergard	1907	Superficial femoral	19	Stab	3 years	Double ligation of artery, lateral ligation of vein	Cure	?
11 Abalos	1909	Superficial femoral	19	Gunshot	?	Suture of artery and vein	Cure	?

12	Zeidler	1910	Superficial femoral	18	Gunshot	2 months	Suture of artery and vein	Cure	Persistent.
13	LeConte and Stewart	1912	Superficial femoral	7	Stab	4 years	Suture of artery and vein	Cure	Persistent.
14	Bramann	1906	Superficial femoral vein, deep femoral artery	17	Stab	?	Double ligation of artery, lateral ligation of vein	Cure	?
15	Manteuffel	1895	Deep femoral	18	Gunshot	?	Suture of artery, resection of vein	Cure	?
16	Wiesinger	1904	Popliteal	18	Gunshot	?	Suture of artery and vein	Cure	Persistent
17	Cranwell	1906	Popliteal	21	Stab	?	Lateral ligation of artery and vein	Cure	?
18	VanEiselberg	1906	Popliteal	38	?	?	Ligation of canal between artery and vein	Recurrence in 3 weeks, extirpation	?
19	Lever	1907	Popliteal	34	Stab	?	Resection and anastomosis of artery and vein	Cure	Persistent
20	Sabadini	1908	Popliteal	19	Stab	?	Lateral ligation of artery and vein	Cure	?
21	Garrè	1908	Popliteal	16	Explosion	1 1/2 years	Resection, anastomosis of artery, double ligation of vein	Cure	Persistent.
22	Aubert	1910	Popliteal	?	Gunshot	?	Double ligation of artery, suture of vein	Cure	?
23	DaCosta	1912	Popliteal	29	Gunshot	3 months	Longitudinal incision of vein, suture of opening in artery from within the vein, division of vein on each side of the opening, with utilization of the flap of vein to reinforce the arterial suture, anastomosis of the vein	Cure	Persistent

lateral vessels that sometimes empty into the sac, is more likely to be followed by recurrence

With aneurorrhaphy the aneurism can be dealt with radically and the vessels conservatively, thus effecting cure without interrupting the blood stream and without producing gangrene. Unfortunately suture of the vessels is not always possible. In a number of instances the surgeon has attacked the aneurism with vascular suture in mind but was forced to abandon the idea because of hemorrhage (Delanglade), friability of the artery (Thompson), the large size of the opening (Mignon), or because of dense adhesions (Cranwell, J C Stewart). Cestan found, after suturing the brachial artery and vein, that the vessels at the sutured point had been obliterated, hence proceeded with resection. Furthermore, in a number of cases the operator, owing to unforeseen difficulties, was compelled to alter his original plan, so that numerous modifications of the typical and ideal method have been adopted. Instead of analyzing these modifications we have considered it best to include them in the subjoined table, in which these cases are grouped according to the vessels affected. It will be noticed that in the 23 cases there was no fatal result and only one recurrence (Case 18). This list, it must be explained, does not contain the cases of arteriovenous wounds that were sutured soon after the accident, of which there are about 10 on record (Matas, Murphy, Lund, Perugnicz, Lissjanski, Oliver, Rost, Sonnenberg, Korte, Stewart). Such cases we believe should be classed, not with arteriovenous aneurism, but with vascular wounds, since in the latter instead of dense adhesions there is a hæmatoma (false traumatic aneurism), and additional factors, *e g*, pre-operative hemorrhage, shock, and infection, come into play.

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DR JOHN H GIBBON remarked as to the case referred to by Dr Stewart which recently was under his care at the Pennsylvania Hospital and in which he did not operate. This man had a gunshot wound, the bullet passing between the subclavian vessels and lodging in the trapezius. He was laid up for two weeks, went back to work, then developed a weakness in the left arm and suffered pain. With this condition he was admitted to the hospital, there was a marked thrill and evident arteriovenous aneurism. Dr Gibbon was quite keen to operate on him, but waited a few days and in that time he showed a great deal of improvement, the pain got very much less, and finally disappeared altogether, the weakness in his arm disappeared until his grip was as good as in the other, and he was finally allowed to go home. He had an arteriovenous fistula, no aneurismal sac, and notwithstanding the heart changes which Dr Stewart refers to it was the wiser thing to let this man go and operate later if his heart condition became so bad as to demand operation. If the heart condition which Dr Stewart found in the boy, which had lasted four years, disappeared within ten days, there was no reason in this case not to wait and watch the progress. Another reason why he did not operate on him was that one is not always as successful in arteriorrhaphy as Dr Stewart was in his case. In a great many of these cases, unless done by such men as Carrel or Sweet, one will get a thrombosis of the vessel and if this man got a thrombosis of his subclavian he would be in a great deal worse condition than he is now.

#### THE EFFECT OF THE REMOVAL OF THE HYPOPHYSIS IN THE DOG

DR J E SWEET and DR A R ALLEN (by invitation) presented a paper with this title, for which see page 485.

DR CHARLES H FRAZIER remarked, with regard to the conflicting testimony as to whether the pituitary body is essential to life, that it seemed to him as time goes on that the evidence is accumulating in favor of the position which he has taken. Dr Sweet will remember a rather crude technic which together they employed five years ago for the removal of the hypophysis. An incision was made through the pharynx exposing the vault, by removing a button of bone with a small conical trephine the sella turcica was opened and the pituitary body exposed, the opportunities for infection were so great and the exposure so limited that complete and satisfactory removal of the pituitary body was not practicable.

# TRANSACTIONS

## OF THE

### NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, held at the New York Academy of Medicine,  
January 8, 1913.*

The President, DR CHARLES L GIBSON, in the Chair

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#### FRACTURE OF THE PATELLA BLAKE OPERATION

DR W S SCHLEY presented a man, 23 years old, who three days before his admission to the hospital had fallen down five steps of a flight of stairs. He did not strike the knee at any time, but on attempting to rise he found that he had no power in the leg and could not support himself. He had not suffered any pain, he did not hear the bone snap and was not aware at the time that he had broken the patella. At operation, the usual transverse fracture of the bone was found, with a wide tear of the lateral patellar ligaments. The Blake operation was done, main reliance being placed upon the two sutures of chromic gut on either side of the patella, and the lateral tears were repaired with interrupted chromic sutures. The patient recovered within four months, with complete restoration of function.

DR SCHLEY presented a second case in the person of a man of 56, who six hours before his admission to the hospital tripped on a car track and fell, striking his knee with much violence. He heard the bone snap, but was able to get up unassisted and walk a block, where he got on a car. Upon attempting to alight from the car he fell, he was unable to rise and had to be carried home. An X-ray, taken at the hospital, showed that the patella was broken into four parts, two of which had retracted upward with the quadriceps tendon, while two had remained attached to the patellar ligament. The patella was operated on by the Blake method, and the so-called capsular ligament was stitched with interrupted chromic gut. Within five months function was practically perfect, and this result would probably have been at-

tamed in a shorter period were it not for the fact that the leg was kept longer than was necessary in a plaster splint

#### RUPTURE OF THE QUADRICEPS-EXTENSOR TENDON

DR SCHLEY presented a man 54 years old, who two weeks before his admission to the hospital slipped on the pavement and fell with the left leg doubled under him. The pain was not severe, but he found that he was unable to rise. When helped to his feet, he fell a second time. He was taken home and treated for the swollen, ecchymotic knee for some days. At operation, the quadriceps was found to have been torn from the upper patellar margin and retracted for a distance of two inches. The lateral expansions were widely torn. There was sufficient tendinous tissue on the patella to mattress the quadriceps with two such stitches, while the lateral ligaments were united with interrupted chromic gut.

The restoration of function in this case was entirely satisfactory.

#### LYMPHANGIOPLASTY OF THE UPPER EXTREMITY (HANDLEY'S METHOD)

DR PARKER SYMS presented a married woman, 60 years old, upon whom he had operated at the Lebanon Hospital for carcinoma of the breast on January 12, 1910. At the time of the operation, the case was a very unfavorable one. The disease was of long standing, the growth had begun to ulcerate, and there was a large cancerous mass beneath the pectoral muscles and in contact with the axillary vein. The technique of the operation was similar to that described by Dr. Willy Meyer, although Dr. Syms said he made a quadrilateral flap from the posterior region somewhat after the manner of Jackson's anterior flap.

A photograph of the patient was shown by Dr. Syms, this was taken one week after the operation, and illustrated the early free motion of the arm. Within a week the patient was able to assume the "Statue of Liberty" attitude, and could move the arm freely in all directions.

In connection with this case, the speaker emphasized two points: *i.e.*, the carrying of the incision well up on to the shoulder, and not making the incision in the axilla. If the incision is

into the axilla instead of over it we might have resulting cicatricial contraction limiting the motion of the arm. The second point was the method of dressing these cases. The skin flaps should be applied to the thoracic wall so as to completely obliterate the axillary and post-axillary spaces. The arm should not be bandaged to the body—it may be carried loosely in a sling, but the suturing and the dressing should be so performed that the arm may at once be lifted to the upright position.

This patient had progressed satisfactorily since the operation. There was no evidence of a recurrence of the cancer at the end of three years, and the only trouble she had had was swelling of the arm and forearm. This began about a year after the operation, and when Dr. Syme again saw her, early in 1912, she had the characteristic brawny arm and forearm.

On March 23, 1912, more than two years after the original operation, he performed Handley's operation, known as lymphangioplasty, inserting two loops of silk into the woman's forearm and arm. One loop extended up the anterior aspect of the arm, the other up the posterior aspect, and the four ends of the silk were brought out over the posterior scapular region, radiating over a wide area. A good description of this operation was to be found in the fifth edition of Bunney's *Operative Surgery*. Dr. Syme said the silk he employed in this case was No. 10 twisted silk. For the purpose of passing the silk thread he devised a double-ended probe, with a bulb and eye at one extremity. The implantation of the silk drains was accomplished with ease, and the healing after the operation was perfect. The results of the operation, however, were entirely disappointing. The silk loops had remained within her arm without giving rise to any irritation or inconvenience, but the swelling of the limb was not diminished by the implantation. This failure may have been due to the fact that only a single instead of a double loop was inserted anteriorly and posteriorly, or it may have been due to the character of the silk employed.

DR. CLARENCE A. MCWILLIAMS said the failure in Dr. Syme's case was perhaps due to the fact that not enough sutures were passed. Handley recommended that three double sutures should be inserted on the anterior surface of the arm, and three posteriorly. It was possible that too few strands were employed in this case.

from a study of the statistics of ligation, is rarely followed by gangrene. Ligation of the subclavian artery causes gangrene in 2 per cent of the cases (von Bergmann), of the axillary in 66 per cent, of the brachial in 18.75 per cent, of the common femoral in from 19 to 21 per cent (Raabe), of both femoral artery and vein in from 48.3 per cent (Ziegler) to 60 per cent (von Bergmann), of the popliteal in 54.5 per cent, of both popliteal artery and vein in all. In 105 extirpations for arteriovenous aneurism, taken from the tables of Delbet and Monod and Vanverts, 99 were followed by recovery, 4 by death, and 3 by gangrene, one case of gangrene being due to ligation for secondary hemorrhage. These cases, among which are not included extirpations of arteriovenous aneurisms of the head, face, neck, and foot, in which there is no danger of gangrene or other serious disturbance in the parts supplied by the artery, are distributed as follows: common carotid 3, with 3 recoveries, external carotid 3, with 3 recoveries, subclavian 2, with 1 recovery, and 1 death within a few hours, axillary 6, with 6 recoveries, brachial 12, with 1 death from erysipelas, common femoral 12, with 12 recoveries, superficial femoral 24, with 23 recoveries, and 1 death within a few hours, deep femoral 1, with 1 recovery, popliteal 28, with 25 recoveries, 1 death on the second day, one gangrene followed by amputation, and 1 partial gangrene of the foot and permanent œdema, tibials and peroneal 14, with 13 recoveries, and 1 death (anterior tibial). In the last case extirpation was followed by sepsis and secondary hemorrhage, necessitating ligation of the popliteal, then of the femoral, and finally amputation for gangrene. Extirpation we would reserve for arteriovenous aneurism involving vessels of the second class, *i.e.*, vessels whose removal would not cause gangrene or other grave nutritional changes in the parts irrigated by the artery, and for most cases in which angiorrhaphy is not feasible.

The ligation methods cannot be wholly discarded however, for in some instances neither angiorrhaphy nor extirpation can be performed, either because of the relations of the aneurism or because of the condition of the patient. Quadruple ligation, *i.e.*, ligation of the artery and the vein above and below the aneurism, is the best of these methods, but so far as gangrene is concerned is no safer than extirpation, and, owing to the presence of col-



stricture of the pylorus had been underestimated, especially by American surgeons. As bearing upon the subject the statistics of the Mayo brothers were as significant as any, showing as they did that in about 70 per cent of cases of cancer of the stomach there was an actual pre-existing ulcer or evidence of an old cicatrized ulcer. Personally, the speaker said, he believed that in dealing with these cases the excision of this ulcer-bearing area was the only logical treatment of a lesion in this situation.

DR A V S LAMBLRT said he was interested in the pathological findings in the case of resection shown by Dr Meyer. His own experience with cases of cancer of the pylorus that had been resected was rather unfortunate in respect to ultimate cures. In the pathological report in this case, the term "pre-cancerous" was used, and he asked Dr Meyer whether he regarded the lesion as benign or malignant.

DR MEYER said that macroscopically the specimen showed no evidence of malignant disease, and the statement of Dr Ewing that there were pre-cancerous changes was apparently based on pathologic microscopical findings. In view of the possibility of this fact, cases of this kind gained in dignity and importance. The speaker thought it was absolutely wrong to base the indication only upon the immediate examination of frozen sections of adjacent glands in dealing with a doubtful lesion of this character. He recalled a case of stricture of the pylorus, the neighboring gland, which a competent pathologist pronounced free from any evidence of malignancy, and yet, within two years, the patient returned with an inoperable cancer of the pylorus. He is of the opinion that the patient's condition alone should guide us, whether he is able to stand resection. The excision of the ulcer-bearing area, as urged by Rodman, of Philadelphia, is certainly the operation of choice.

#### GASTROSTOMY AND ŒSOPHAGOPLASTY FIRST STAGE

DR WILLY MEYER's second case was one of gastrostomy and Œsophagoplasty, first stage, according to the method of Janu-Roepke. In this operation a flap is cut out from the major curvature of the stomach, which is transformed, by double suture, into a tube, and connects with the fundus. A tube 20 to 25 cm in length can thus be obtained. In this instance, it was used by Dr.

M extra-thoracically, being conducted underneath the left pectoralis major muscle, up to the third rib. He stated that this operation might furnish good material for the immediate reconstruction of the lower portion of the œsophagus and cardia, intrathoracically, after resection for carcinoma.

A more detailed description of the operation will soon appear as a separate article in the *ANNALS OF SURGERY*.

DR. N. W. GREEN said the method described by Dr. Meyer had gone a long way towards the solution of the treatment of carcinoma of the lower end of the œsophagus. Whether it would ever be possible to secure any lasting benefit from excision of the growth was a very doubtful question. These plastic measures, however, would serve to temporarily restore the patency of the œsophageal tube. In most of the cases where the operation of resection of the growth had thus far been attempted, the patients had died from septic infection of the pleura rather shortly after the operation, one, he believed, had survived the operation for several days. If the growth were unmolested such a patient might live for months, possibly a year. This phase of the problem had not yet been worked out.

Dr. Green thought that possibly the condition of these patients might be ameliorated by some such procedure as Dr. Meyer had shown in this case. It might well lend itself to side-tracking the growth in the chest by an œsophago-gastrostomy above it. The experimental procedure of side-tracking the cardia in dogs was not difficult, it was apparently less fatal than attempts at resecting the cardia, and applied to the human subject might perhaps add to the confidence of both the profession and the laity by making operative interference in this region less rapidly fatal.

DR. MEYER, in closing, said he disagreed with Roepke, who in his article on this subject advised the Jiamu method of gastrostomy in preference to all others, and favored that method rather than that of Senn, Witzel, Kader, and others on account of the annoyance of leakage, after the latter operations. Dr. Meyer said he had very rarely seen it occur when using the well-known methods of gastrostomy.

Referring to Dr. Green's remark on the imminent danger of sepsis after intrathoracic operations on the œsophagus, he thought that this danger had been greatly lessened since we had learned to drain the pleura after intrathoracic work. At the German Hos-

stricture of the pylorus had been underestimated, especially by American surgeons. As bearing upon the subject, the statistics of the Mayo brothers were as significant as any, showing as they did that in about 70 per cent of cases of cancer of the stomach there was an actual pre-existing ulcer or evidence of an old cicatrized ulcer. Personally, the speaker said, he believed that in dealing with these cases the excision of this ulcer-bearing area was the only logical treatment of a lesion in this situation.

DR A V S LAMBERI said he was interested in the pathological findings in the case of resection shown by Dr Meyer. His own experience with cases of cancer of the pylorus that had been resected was rather unfortunate in respect to ultimate cures. In the pathological report in this case, the term "pre-cancerous" was used, and he asked Dr Meyer whether he regarded the lesion as benign or malignant.

DR MEYER said that macroscopically the specimen showed no evidence of malignant disease, and the statement of Dr Ewing that there were pre-cancerous changes was apparently based on pathologic microscopical findings. In view of the possibility of this fact, cases of this kind gained in dignity and importance. The speaker thought it was absolutely wrong to base the indication only upon the immediate examination of frozen sections of adjacent glands in dealing with a doubtful lesion of this character. He recalled a case of stricture of the pylorus, the neighboring gland, which a competent pathologist pronounced free from any evidence of malignancy, and yet, within two years, the patient returned with an inoperable cancer of the pylorus. He is of the opinion that the patient's condition alone should guide us, whether he is able to stand resection. The excision of the ulcer-bearing area, as urged by Rodman, of Philadelphia, is certainly the operation of choice.

#### GASTROSTOMY AND ŒSOPHAGOPLASTY FIRST STAGE

DR WILLY MEYER's second case was one of gastrostomy and œsophagoplasty, first stage, according to the method of Janu-Roepke. In this operation a flap is cut out from the major curvature of the stomach, which is transformed, by double suture, into a tube, and connects with the fundus. A tube 20 to 25 cm in length can thus be obtained. In this instance, it was used by Dr

M extra-thoracically, being conducted underneath the left pectoralis major muscle, up to the third rib. He stated that this operation might furnish good material for the immediate reconstruction of the lower portion of the œsophagus and cardia, intrathoracically, after resection for carcinoma.

A more detailed description of the operation will soon appear as a separate article in the *ANNALS OF SURGERY*.

DR N W GREEN said the method described by Dr Meyer had gone a long way towards the solution of the treatment of carcinoma of the lower end of the œsophagus. Whether it would ever be possible to secure any lasting benefit from excision of the growth was a very doubtful question. These plastic measures, however, would serve to temporarily restore the patency of the œsophageal tube. In most of the cases where the operation of resection of the growth had thus far been attempted, the patients had died from septic infection of the pleura rather shortly after the operation, one, he believed, had survived the operation for several days. If the growth were unmolested such a patient might live for months, possibly a year. This phase of the problem had not yet been worked out.

Dr Green thought that possibly the condition of these patients might be ameliorated by some such procedure as Dr Meyer had shown in this case. It might well lend itself to side-tracking the growth in the chest by an œsophago-gastrostomy above it. The experimental procedure of side-tracking the cardia in dogs was not difficult, it was apparently less fatal than attempts at resecting the cardia, and applied to the human subject might perhaps add to the confidence of both the profession and the laity by making operative interference in this region less rapidly fatal.

DR MEYER, in closing, said he disagreed with Roepke, who in his article on this subject advised the Jianu method of gastrostomy in preference to all others, and favored that method rather than that of Senn, Witzel, Kader, and others on account of the annoyance of leakage, after the latter operations. Dr Meyer said he had very rarely seen it occur when using the well-known methods of gastrostomy.

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in favor of getting the consent of typhoid patients to submit to an operation, should such an emergency arise, even prior to their admission to the hospital. Early operation, he believed, would greatly reduce the mortality in these cases.

DR LAMBERT suggested that a local anæsthetic was advisable in operating for perforated typhoid ulcer, as the administration of ether was apt to lead to pulmonary complications in these patients, in their low state of vitality.

#### OCCIPITAL DECOMPRESSION FOR EARLY SYMPTOMS OF MENINGITIS IN A CASE OF COMPOUND DEPRESSED FRACTURE OF THE SKULL

DR WILLIAM A DOWNES presented a boy, 21 years old, who was admitted to the accident ward of the New York Hospital on November 2, 1912, shortly after having been struck on the head by an iron girder. On admission, he was in a condition of stupor, but was able to answer questions. The head showed a transverse scalp wound, two and a half inches long, in the left parietal region just posterior to the Rolandic area. Exploration revealed what was thought to be a linear fracture, without depression, extending the length of the scalp wound. There was no paralysis, the pupils were equal and reacted actively to light. The reflexes were normal. There was retention of urine, the patient vomited once and showed symptoms of severe concussion. His temperature ranged between 100 and 101, the pulse gradually fell from 70 to 50 in the next four days.

On November 8, six days after admission, the patient's neck became rigid. There was marked photophobia, the Kernig sign was present. The blood pressure, which had ranged between 100 and 110 mm, went to 130 mm, pulse 44, temperature, 101, leucocyte count, 12,000, with 81 per cent of polymorphonuclears. Half an ounce of slightly cloudy spinal fluid under pressure was withdrawn by lumbar puncture. This fluid remained sterile after seventy-two hours.

The case was regarded as one of early meningitis, and an occipital decompression with the intention of establishing free drainage was done by Dr Downes on November 8, about six hours after the appearance of stiffness in the neck muscles. When the scalp wound was explored, under anæsthesia, the posterior margin of a piece of bone one inch by two and a half inches was found depressed. Upon elevating and removing this fragment

which was comminuted, the dura showed a rent two inches long. Considerable cerebro-spinal fluid escaped at this time. There was marked congestion of the exposed brain surface, but the brain tissue had not been lacerated. The pia had lost its lustre and assumed a milky appearance. The opening in the dura was enlarged and a rubber tissue drain inserted.

The symptoms, together with the above findings, led Dr. Downes to believe that infection had taken place, and that free drainage was essential. Therefore, a liberal-sized bone flap, three and a half by two and a half by two inches, with its base just above the foramen magnum, was cut with the Kenyon saw without injuring the dura at any point, and turned down, exposing the posterior lobes of both the cerebrum and cerebellum. The torcular occupied the centre of the exposed surface. The dura was incised just above the tentorium on either side, and about half an ounce of fluid drained from the left side. Incisions were also made in the dura over the cerebellar lobes well down to the cisterna magna, and again considerable fluid escaped. All of the escaped fluid was slightly cloudy. Cultures were taken at each point where the dura was opened.

Rubber tissue drains were inserted into the dural openings and brought out through the drill holes at the angles of the bone flap, which was then replaced. Within twenty-four hours the rigidity of the neck muscles had disappeared. The pulse rose to 72, the blood pressure was 110 mm. The temperature remained at 101.4 for two days, and then dropped to normal, where it remained excepting for a slight rise on the tenth day due to a mild cystitis which quickly yielded to treatment. The wound healed throughout by primary union, the drains were gradually removed after the second day and the patient was discharged from the hospital on December 24, 1912.

The cultures that had been made remained sterile after 72 hours, so what was taken to be an early septic meningitis resolved itself into a serous meningitis (Quincke), treated by occipital decompression.

#### CONGENITAL INTERNAL HYDROCEPHALUS ITS TREATMENT BY DRAINAGE OF THE CISTERNA MAGNA INTO THE CRANIAL SINUSES

DR IRVING S. HAYNES presented a paper with the above title, for which see p. 449.

## CORRESPONDENCE.

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### AN ARTIFICIAL HAND OF THE MIDDLE AGES

THE accompanying illustrations afford us a material demonstration of the efforts of our confrères in by-gone times to substitute artificial limbs for such as may have been lost in warfare or by other means

Although prosthetic appliances seem to have been known in very early times, the first attempts to replace mutilated extremities by mechanical appliances do not apparently antedate the beginning of the sixteenth century, and the earliest artificial hand with mechanical attachments of which we have any definite knowledge is that which has become famous by its association with the old knight, Goetz von Berlichingen. This has been carefully described and illustrated in a work by Karpinski, a German military surgeon (Berlin, 1881). His diagrammatic studies show that this particular hand was provided with a number of buttons and levers with the assistance of which certain movements could be accomplished. In this same book is also figured an earlier mechanical hand dating back to the fifteenth century and from an unknown source. These seem to be among the earliest known artificial hands about which any information has descended to us. It is probable that these and similar contrivances were made by armorers, who would naturally be most proficient in adapting their methods to this form of prosthetic appliances.

The contrivance from which the accompanying photographs were made was kindly loaned to the writer by Dr. Bashford Dean, curator of arms and armor at the Metropolitan Museum of Art, New York, and is believed by him to be of German origin. It is of a very primitive construction, but the modelling of the wrist is quite noteworthy, as may be gathered from the delicate protrusion on the outer side of the hand, corresponding to the ulnar eminence. The fingers have each two articulations which are so arranged that although almost complete flexion is possible, extension beyond the normal cannot occur. The thumb has two





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articulations and it is probable that the wearer of this appliance was still provided with this digit and could fix it in the appropriate opening. The short distance from the wrist to the edge of the cuff also adds to the testimony that probably only the fingers and part of the hand were absent in the original subject, because a much greater length of cuff would have been necessary if the limb had been shorter. The material from which the hand is made is a fine quality of what seems to be cast steel, as no joints can be detected. The openings in the cuff were probably for the adjustment of leather thumbs and no traces can be found of any mechanism such as springs or other contrivances for communicating any motion to the artificial fingers.

The specimen constitutes a most interesting relic of the past and shows the assistance rendered to prosthetic surgery of those days by the armorers' craft.

GEORGE W. KOSMAK, M.D.

NEW YORK CITY

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# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS.

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### ARTHROPLASTY.

BY JOHN B MURPHY, M D,  
OF CHICAGO

Professor of Surgery in the Northwestern University Medical School

ARTHROPLASTY, the restitution of functional activity in joints rendered useless by ankylosis, is no longer a dream or even a curiosity among surgical procedures. The operation has established a place for itself and is now one of the recognized procedures for the treatment of ankylosis. However, because of the fact that the execution of the operation requires considerable skill and ingenuity, and a knowledge par excellence of the principles of asepsis, none but a skilled and experienced surgeon should undertake it and he only after having performed the operation repeatedly, first, on the several joints of the cadaver and, second, on animals.

As the details in technic and the after-treatment are perfected, better results will be obtained with less difficulty than at the present time, and a greater number of operators of experience will perform the operation and probably simplify the technic. As the matter stands to-day, only a few of the many skilled surgeons in this and other countries have the courage and sufficient confidence in their ability to do an arthroplasty. Each man has worked out a technic which has given him good results, but which has not, in the main, met with the unequal-

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fied approval of his confrères. It is results, however, for which we are striving, and as to which is the best technic and the best after-treatment will be determined only when the ultimate results can be compared in a large number of cases.

We will not at this time attempt to discuss the work of others. We will limit ourselves absolutely to the presentation of the results of our own work and observations. We have done in Mercy Hospital alone, 62 arthroplasties for bony ankylosis of joints, namely: hip, 16; knee, 28; toe, 1; shoulder, 1; elbow, 12; wrist, 1; and jaw, 3. We have had occasion to change details of technic as well as after-treatment. But let us begin at the beginning.

About 1900, I first became interested in the surgical treatment of ankylosed joints by means of arthroplasty; that is, the operation looking toward the formation of a new joint which would be as nearly like a normal joint as it is possible to make it, a joint which at least would resemble a natural joint in every detail functionally and possibly anatomically. Basing my theory for the performance of arthroplasties on the clinical observation which has been made by generations of physicians, that when muscle, fascia, ligaments or any other tissue is interposed between the ends of fractured bones a pseudarthrosis results, with the formation of intra-articular cartilage and membranes with a fluid resembling synovia; and a well developed fibrous capsule, I undertook experiments on animals, looking toward the formation of new joints, and the result was my original arthroplasty, done July 26, 1902. In other than the hip the original operation has undergone many modifications in my hands, but the principles involved have not changed.

The subject of ankylosis and its treatment presents many problems for consideration, and in order to understand the treatment of this condition and to appreciate the principles that are involved in the performance of an arthroplasty, a full and accurate knowledge of the embryology and anatomy of joints is an absolute essential. What is a joint? What is

the embryology of a joint? What is the pathology of a false joint, a pseudarthrosis? What is the pathology of ankylosis? Can we make a new joint? If so, how nearly will it resemble anatomically a natural joint? Will it be as useful as well as a usable joint? Can we restore motion in it and to what degree? Are we able to provide a synovial lining for the joint surfaces? If not, can we provide a lining which will answer the purposes of a synovial lining? These are all questions which must be answered before one can undertake the proper and intelligent treatment of ankylosis

In my original article,<sup>1</sup> I discussed in detail the embryology of joints, and in a more recent series of articles,<sup>2</sup> I took up the subject at even greater length. At the present time I have formulated very definite rules which govern most of the phases of this subject which are apt to present themselves to the surgeon

The principal point to be considered in this connection is the fact that ankylosis is the result of various pathologic conditions, that it involves many tissues and that, therefore, we meet with many varieties of ankylosis. For clinical purposes we may divide the ankyloses into (1) bony; (2) cartilaginous, (3) fibrous, (4) periarticular-ligamentous-capsular, and (5) extra-articular, involving skin scars, tendons, fascia, nerves and arteries. The age of the individual would, of course, be one element to consider, because histologically all tissues change with age, a fact which must be considered in treatment. Ankyloses occur at all ages and they are most common in adults, but ankyloses in children are quite common, both single and multiple, from hæmatogenous metastatic infections. I have reported a diagnosis made of ankylosis of a right elbow-joint in a fetus *in utero* in the eighth month of gestation. The report and skiagram of this case were published in *Journal of the American Medical Association*, March 16, 1912. On palpation it seemed to me that

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<sup>1</sup> The Journal A. M. A., May 20, 1905

<sup>2</sup> The Journal A. M. A., April, May and June, 1912.

the anterior arm of the fetus was unduly prominent and rigid, and that the hand was fixed in front of the face. It was easily palpable and almost visible through the abdominal wall. I had a skiagram made which showed the forearm in practically the full extended position with the elbow-joint ankylosed. At the birth of the child, one month later, the diagnosis was confirmed. There was complete fixation of the right elbow, the left elbow could be flexed to a slight degree. I believe that the fixation in the right arm was the result of an arrest of development in the bones entering into the formation of the joints before the joint had completely formed. This, I think, was the first case of this kind in which the diagnosis was made from a skiagram of a fetus *in utero*.

To return to our subject. In the management of ankyloses, the various elements producing the ankylosis must be taken into consideration. From a practical standpoint, however, the osseous, cartilaginous and intra-articular fibrous varieties may be considered under one head. The osseous-fibrous and capsular types of ankylosis yield only to arthroplasty, whereas the periarticular and extra-articular types may be treated successfully by capsulotomy, tendon elongation or excision of the exostoses. Whenever the arteries, nerves and tendons are materially shortened by prolonged flexion of the joints, excision of part of the bone with a view to shortening it is the only operation to be considered. In this paper, however, we will take up only the bony types of ankylosis.

The main principle of the operation consists in interposing between the ends of the bones, after their separation, some material which will prevent the recurrence of bony union. Various substances have been used for this purpose, but we are firmly convinced that the best interposing material is a pedicled flap of fat and fascia lifted from the tissues in the neighborhood of the joint, or if that is not possible, for reasons that will be mentioned later, then a detached flap of fat and fascia from the trochanteric bursal portion of the fascia lata may be transplanted between the ends of the bones. We have observed these cases for so long a time that we are firmly

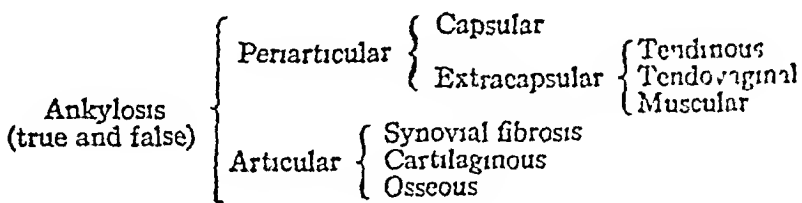
convinced of the correctness of this statement Homo- and hetero-transplants are not uniform in results

Next in importance is the restoration of the normal anatomic conformation of the joint as nearly as possible, in order that the patient will have a useful as well as a movable joint. In the case of the knee, for instance, he must be able not only to support the weight of his body on the leg operated on, but he must be able to walk, to run, to climb stairs, supporting his entire weight on that leg.

It is only natural that a clinical experience extending over a period of eleven years, preceded by very extended and careful experimental work, has made us rather positive in our statements and firm in our convictions.

As stated above, we have had occasion as the result of clinical observation to change our technic in minor details, but we have seen no reason for abandoning the principles which we laid down originally as governing the surgical treatment of ankylosis.

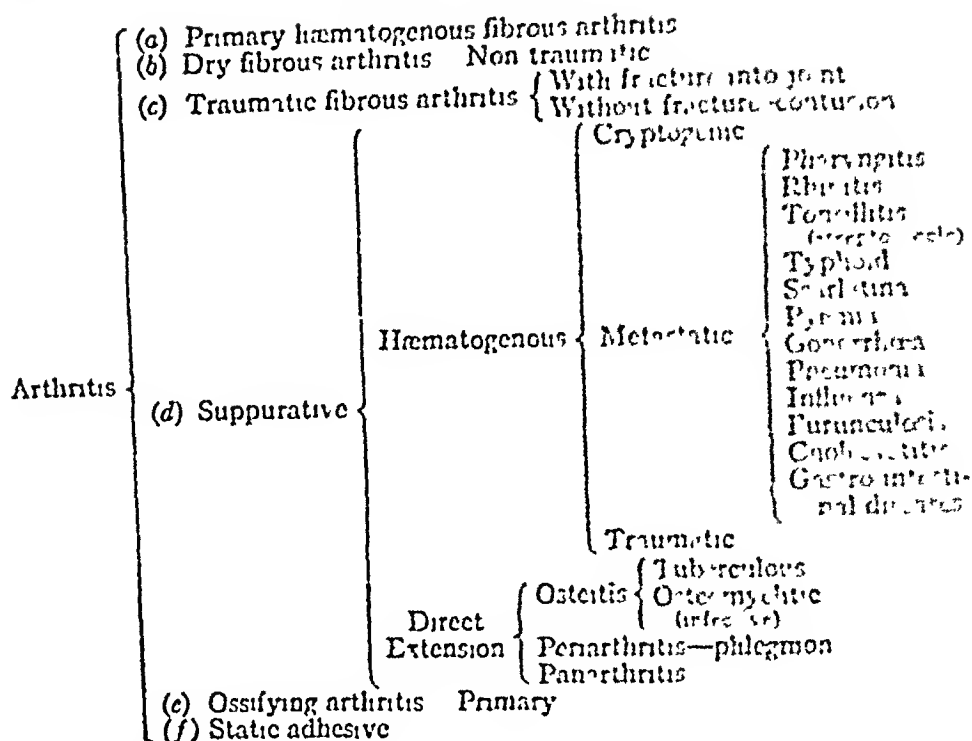
It may not be amiss here, again, to present in this connection our original classification of ankyloses and the types of arthritis which lead to the varieties of ankylosis mentioned in the classification.



The types of arthritis which lead to the varieties of ankylosis are practically all direct metastases from foci of infection elsewhere in the body, and which are usually called rheumatism, but there is no such disease as acute non-infectious inflammatory rheumatism. These inflammations in joints are all metastatic arthritides.

Space does not permit of a discussion of the varieties of arthritis mentioned in the table and by reference to the original article <sup>1</sup> these points will be found mentioned at some length.





We cannot at this time enter into the consideration of the history of arthroplasty. This phase of the subject has been discussed admirably by many clinicians and was reviewed in my article just mentioned.

In general, the elements which have contributed most to the failures following arthroplasty have been (1) the insufficient or defective excision of the capsule and ligaments; (2) insufficient interposition of fat and fascia between the separated bony surfaces, (3) infection, (4) sensitiveness to pain on motion after operation. Where osseous union has existed, it is important to separate the bones in the normal line of union as nearly as possible. All bony prominences that may impinge against other bones in extreme degrees of motion should be removed, as, for instance, the coronoid process of the ulna and the tip of the olecranon. The soft parts should be liberated most thoroughly.

The interposing material, and this is a point that cannot be emphasized sufficiently, must cover the entire articular surface of the bones, being attached, however, to only one bone.

A point to be remembered in arthroplasty is that flaps receive nutrition rapidly from the rich vascular supply to the ends of the bones, and inasmuch as the flaps which we use consist of fat and fascia, which have but slight vascularity, they do not perish readily, receiving their nutriment by osmosis from the bones, while a new circulation is developed in the flap

It is, of course, highly essential that the strictest asepsis must be practised in the performance of the operation. Nothing whatever, except a sterilized instrument or a sponge, should come in contact with any portion of the wound. The skin surface, no matter how well disinfected it may be, should always be covered with sterilized towels, the towels should overlap the edges of the incision and be fastened there with towel forceps. Not even a gloved hand must be allowed to come in contact with the wound, sponge or instrument. The acme of refinement in surgical asepsis must be practised in these operations in order that there may not be the slightest chance of having an infection occur. The nutrition of the tissues is such that they cannot withstand infection as well as normal tissue does, and therefore we are exceedingly careful in practising all the principles of asepsis.

If sepsis does occur the entire procedure is likely to be nullified. In some of the cases where the bones were divided, we found encapsulated foci of suppuration. In one case of typhoid arthritis there was a clean-cut typhoid abscess in the knee-joint. This was followed by suppuration. Two other patients had tuberculous abscesses in the joint years after the ankylosis occurred. We are more fearful doing an arthroplasty on a joint that was primarily tuberculous than on any other type of ankylosed joint. The process of repair is slower, the tendency to blood oozing from the traumatized tissues is greater, exposing these cases to the danger of infection for weeks. Two of our patients had a hæmophilic tendency, which we have found occasionally accompanies tuberculosis of the knee-joint. We mention these untoward conditions because we have met them in our work. We do not attempt arthroplasty in any case in which there is an



FIG 1

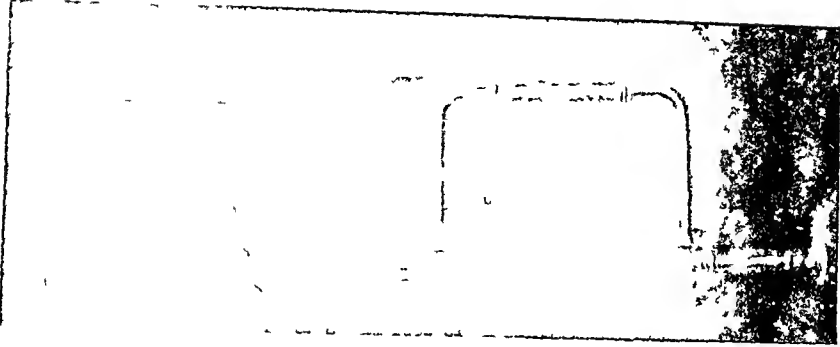
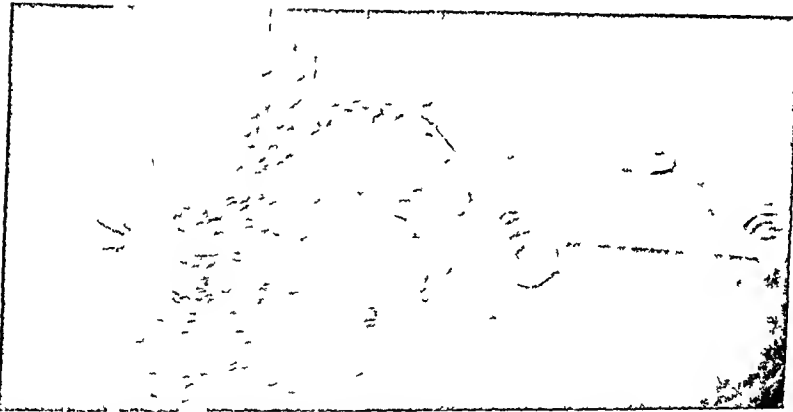


FIG 2



FIGS. 1 and 2 --Side and end view of author's reamer and end mill with handle. This instrument is used to restore the normal conformation of bones forming enarthrodial joint.

extends upward for a distance of about 5 inches in a straight line with the anterior superior spine of the ilium. These incisions are employed interchangeably as is demanded by the individual case.

The next step in the operation is to free the trochanter from the shaft, leaving its muscles attached to it.

A large, curved, flat, blunt-pointed needle, chain-saw carrier, threaded with heavy silk, is passed around the base of the trochanter from before backward and the chain saw is next brought into position. The trochanter is carefully sawed off downward and outward and is retracted upward out of the field of operation, carrying with it the attached muscles. The obturators and pyriformis are then divided and both ends transfixed with sutures for subsequent approximation. The joint is now freely exposed and the next step in the operation consists in incising the capsule of the joint around the neck of the femur and pulling it upward to the margin of the acetabulum, without, however, freeing it from its attachment to the latter. It is merely loosened from the neck of the femur and stripped upward toward the head of the bone, so that it can be interposed later between the head of the bone and the acetabulum, if needed, so as to assist in the formation of a new lining for the acetabular cavity.

The next step in the operation is the formation of a new acetabular cavity and a new femoral head. The first thing to be done is to separate the ankylosed head from the ilium as near the normal anatomic line as possible. This is done by chiselling out the bony tissue filling the acetabular cavity by means of an ordinary carpenter's or cabinetmaker's curved chisel, about  $1\frac{1}{2}$  inches in width. With properly directed blows and sufficient force, the chisel is driven in obliquely toward the acetabular cavity for the depth of 1 inch all the way around the head, as near the normal conformation as possible. When the chiselling process is complete, with the chisel as a lever and the thigh held by an assistant, the head is fractured out of the acetabulum, the acetabular cavity is then fashioned with a special globular drill or reamer, so as

to receive the new femoral head, which will be similarly fashioned from the bony mass chiselled out of the acetabulum. For this purpose use is made of a specially constructed cup-shaped end-mill, making it possible to provide a new femoral head of normal conformation and smoothness.

These two instruments used in fashioning the acetabulum and the femoral head constitute, in reality, parts of the same appliance, the globular portion fits into the cup-shaped portion in such a manner that unless the interposing tissues are in position the fit is perfect (Figs 1 and 2).

The main reliance for obviating the recurrence of the ankylosis is placed on the flap of the deflected fascia lata, which is made by splitting the original U-shaped flap. This flap is dissected of fascia lata and a layer of subcutaneous fatty tissue which formed the inner part of the original skin and fascia flap, the base of the U having been originally directed upward so that the nutrition of the flap is preserved as much as possible to insure its continued vitality. Grasping the edge of the flap with tissue forceps, it is drawn into the joint, passed over the femoral head and the edge of the flap may be sutured to the acetabular margin or to the remnant of the capsular ligament which is still attached to the neck of the bone with phosphor-bronze wire or chromicized catgut, thus forming a complete covering for the head and neck of the femur. When the head is placed into the acetabular cavity, this flap also serves as a lining for this cavity and reenforces the capsular ligament, although the latter is used mainly for the purpose of preventing a "locking" of the joint by the formation of exostoses on the acetabular rim following the operation.

The next step is to replace the trochanter, which it will be remembered was sawed off from the bone without disturbing the muscular attachments. Then the ends of the obturator and pyriformis muscles are reunited. The trochanter is brought down, fitted on to its original position, and securely fastened with a wire nail, six- or eight-penny, depending on the size of the trochanter and the degree of tension which may



four weeks. It is removed when it is apparent that the patient has a fair degree of motion in the joint, without much pain or discomfort. He is then allowed to be up and around on crutches and is encouraged to swing the leg in all directions, increasing motion in the joint by every means possible. The stitches are usually removed on the tenth or the twelfth day, and a fresh dressing is made, minus the condition. The subsequent treatment of the wound is that usually employed in any operative procedure.

The following are a few illustrative cases and represent the results that may be obtained in the hip from arthroplasty.

#### ANKYLOSIS OF HIP FOLLOWING EXPOSURE

CASE I—Mrs. M. De G., aged 34, admitted to hospital September 22, 1911. September, 1904, she drove three miles in an open buggy, felt chilled and when she tried to get up and put on her coat she felt a sharp pain in the left hip on standing or sitting. She took a hot bath that night, perspiring freely, and changed her underwear from heavy to lighter weight. On arising from her chair that evening she noticed some pain in the hip which continued, the hip also becoming tender. That night she felt feverish, but had no distinct chill. A physician saw her the following morning and said that she had fever. She had headache, was dizzy and remained in bed. When she got up she could not walk because of the severe pain in the hip. Had temperature for three days, but no chill or vomiting. She remained in bed three months. At first the pain in the hip was constant, then it was felt only on attempted motion. There was great swelling and tenderness. The leg remained straight while in bed, without support or extension, but later it became completely rotated outward.

After six weeks massage was instituted, but it caused great pain and gave no result. After three months she was out of bed on crutches, had no pain, except on walking. The left knee was stiff until after four weeks of massage, when she could bend it, but had to use a crutch and cane. The knee was then all right.

*Examination*—The leg was straight. The hip absolutely immovable. The skiagram showed a complete bony ankylosis (Fig. 3).



be required. This nail is driven into the bone along the axis of the neck.

The deep fascia is reapproximated by means of phosphor-bronze wire, the superficial soft structures are sutured with chromicized catgut, and the skin with interrupted silkworm-gut, and horse-hair sutures. No drainage is used.

The field of operation is freely dusted with bismuth sub-iodide powder, and the wound is then sealed with gauze saturated with collodion. A large pad of 5 per cent. moist phenolized gauze is placed over the hip, extending from 4 to 6 inches beyond the line of incision on either side. A sterile dressing is placed over all, and held firmly in place by spica bandages and wide strips of adhesive plaster. The patient is then placed in the Rainey tractors splint and a Buck's extension, with 20 pounds weight, applied to the leg in the usual manner to overcome the involuntary muscular contraction of the flexors and adductors of the thigh, and to prevent pressure necrosis of the newly interposed flap. The limb is dressed in an abducted position.

We always place the patient in this splint with both legs abducted, for the reason that we have found that when only one leg is abducted, the patient unconsciously throws his body to the opposite side so as to bring it in a straight line with the operated leg, and thus really abducts the leg not operated on. By placing the patient in the splint with both legs abducted, it is impossible for him to change his position without a great deal of discomfort to himself, therefore we are certain to secure the desired abduction of the operated leg.

The patient is kept in bed in the dorsal position, as quiet as possible, for from seven to ten days, when passive motion is instituted. This consists at first in raising and lowering the leg as much as conditions will permit, and in attempting to flex the leg on the thigh and the thigh on the abdomen. This is done every day, and at the beginning of the second or third week, depending on the progress of the case, lateral movements are begun, consisting in forcible abduction and adduction. The splint is allowed to remain on for about three or



*Operation* (September 27, 1911) —The usual arthroplasty was performed, as described above, making the U-shaped incision and interposing a pedicled flap. The result was a splendid one (Fig 4). The patient left the hospital in ten weeks with good motion in the hip, as shown in the photographs (Figs 5, 6, 7 and 8).

She was seen again June 5, 1912. She had a slight limp, the result of about three-quarters of an inch of shortening. She could swing the leg in all directions, and easily bring it up to more than right angles with her body. She walks with a cane when on the street. She uses no support at all around the house.

**CASE II** —Mrs B. S., aged 32, was admitted to Mercy Hospital Jan 1, 1912. Her mother died of tuberculosis when patient was 3 years old. Personal history was negative. Four years ago, following severe exposure to cold, the patient complained of severe pain in the right shoulder and hip for which she took morphine. Following this she had a severe chill, but does not know whether she had any temperature elevation. Pain was present, radiating from hip to groin, severe in character and extending upward over the entire abdomen. The abdomen was very tender to pressure; pain most intense in right groin. This lasted for two weeks. Shortly afterward she had fever for two weeks, then a leucorrhœal discharge which subsided with the pain. There was a mass in the right side of the abdomen about the size of a teacup. She did not menstruate for six months.

The pain in the right hip increased on motion and she remained in bed for three months, the hip not being moved. When motion was attempted in the hip it was found to be ankylosed. The right knee was also stiff, but was relieved by massage and active motion. No other joint was involved, but the ankylosis of the hip was complete and the leg was adducted across the middle line, occluding the inlet and outlet to the pelvis (Fig 9). The skiagram shows a bony ankylosis.

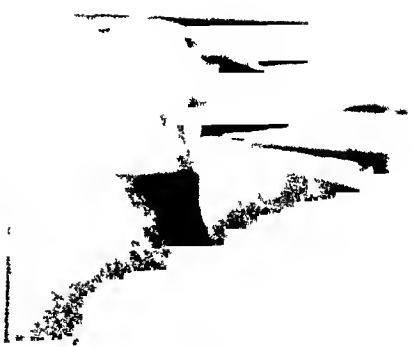
*Treatment* —A typical arthroplasty was done on the hip with the interposition of a pedicled fascial flap. The wound was closed in the regular way without drainage. At the end of seven days a hæmatoma threatened to open the line of suture. Some of the stitches were removed to allow the blood to escape. Eight or ten days after this the patient had a pyocyanus infection with a large quantity of greenish purulent discharge. She was

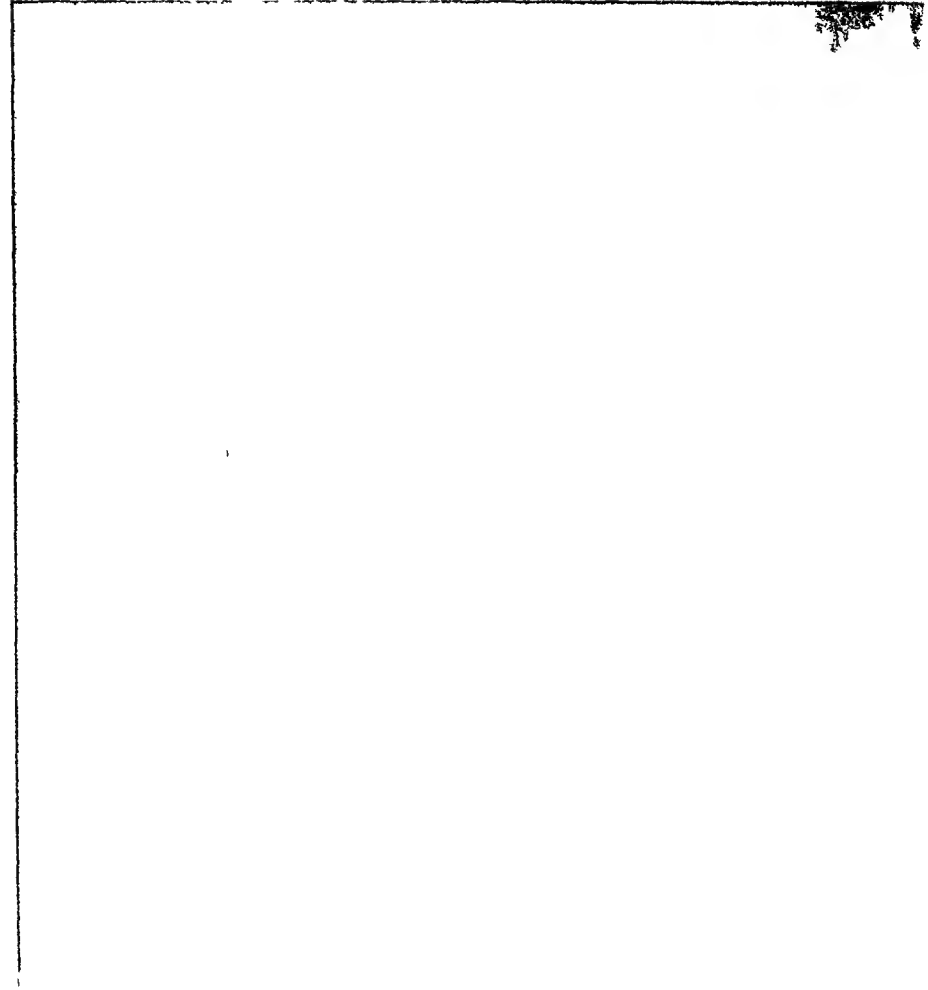
Case I Complete bony ankylosis of left hip The normal anatomy of the joint is lost The knee is turned inward slightly

Case I Shagram made one month after the operation will be noted that the joint anatomy has been restored and the leg is in normal position



Fig 6



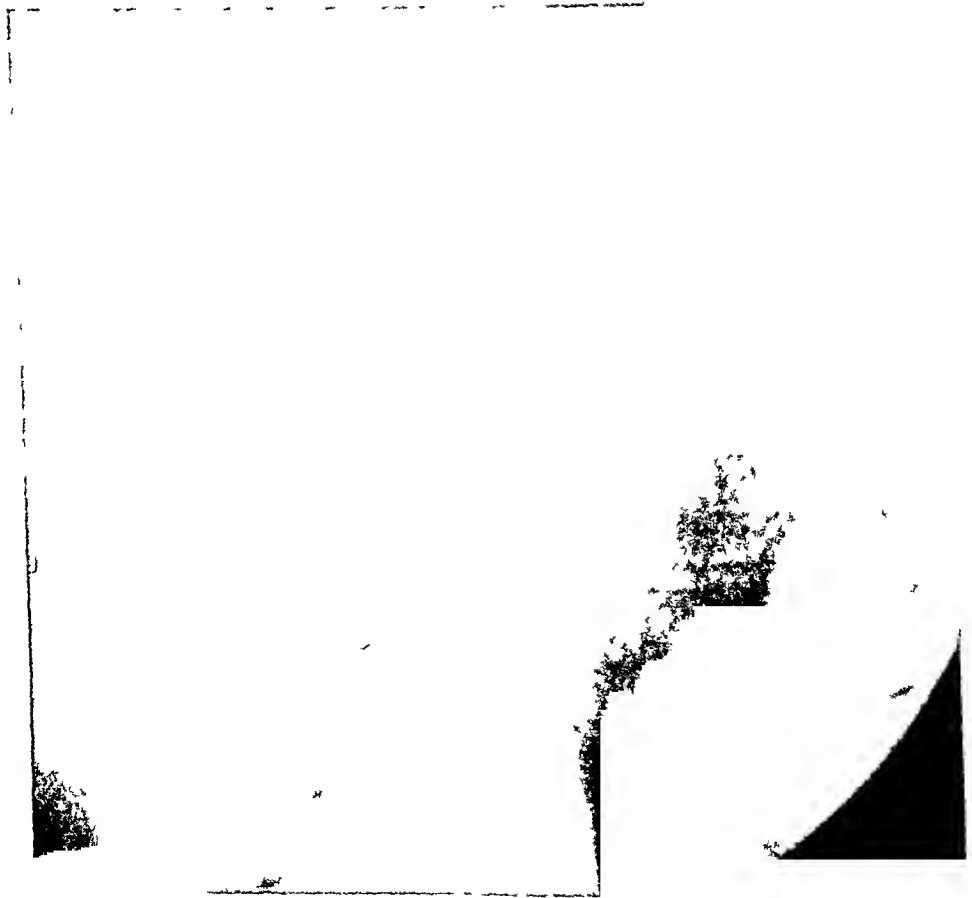


Case II. Complete loss of the  
adduction of the head of the



Case II. The patient was in  
inapparent health at the  
the trochanter which was  
prophylactic.

The patient was in  
inapparent health at the  
the trochanter which was  
prophylactic.



Case II. Skiagram made after the nails were removed from the trochanter

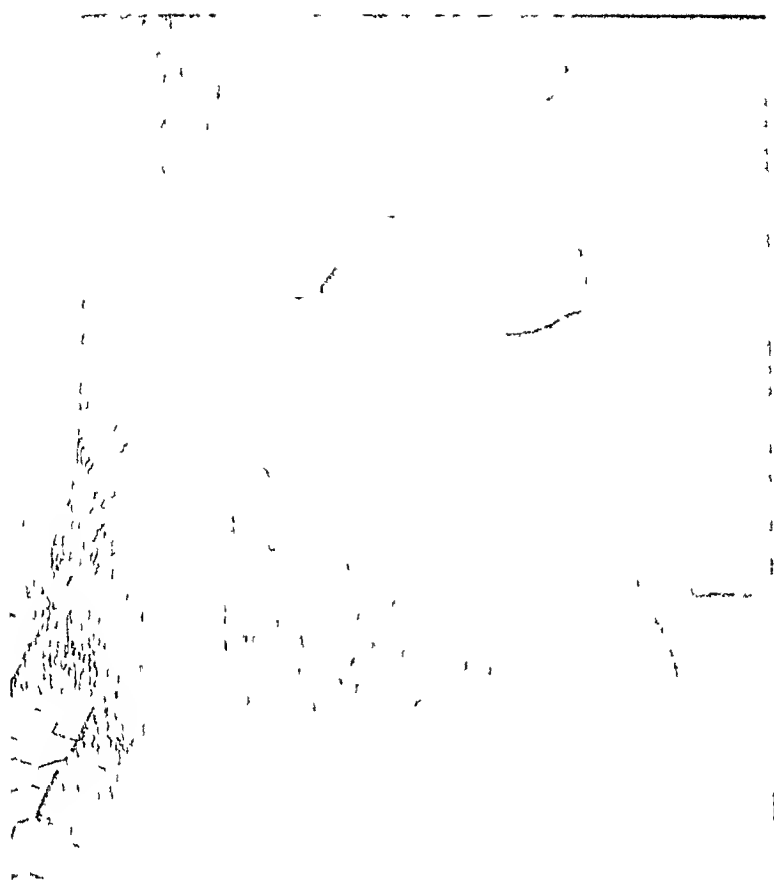
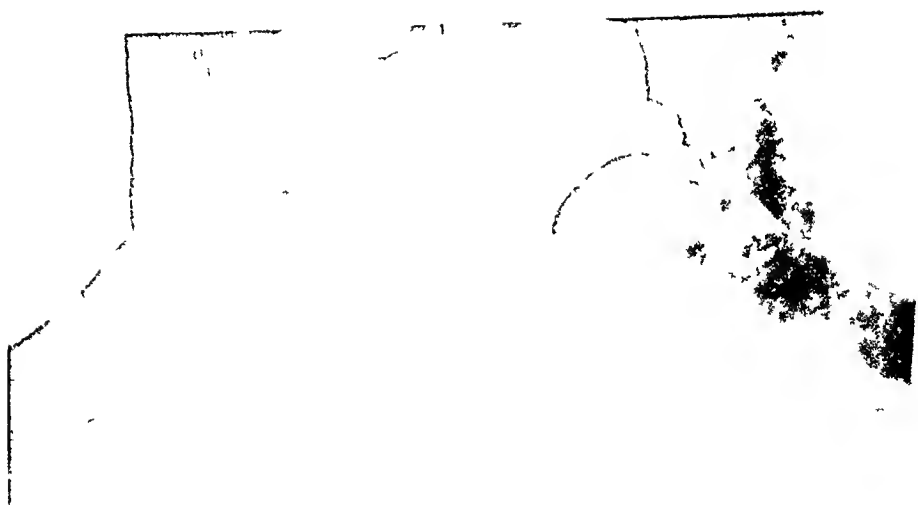


FIG. 5







FIGS. 12, 13, 14 and 15 — Case II. Photograph made four months after operation. Patient had a good range of motion in the joint.

given three injections of a stock pyocyaneus vaccine and the discharge subsided entirely. The case went on to primary union

*Result*—She left the hospital four months after the operation, and at that time was able to put the limb through a great latitude of motion and practically without pain. Following her return home she had two attacks of suppuration from the trochanter. This was believed to be due to the iron nails. She came back to the hospital and the iron nails were removed. Primary union resulted and there was no return of manifestation of the infection (Figs 10 and 11). She walks with an elevation on the heel of her shoe of three-quarters of an inch. There is practically no limitation of motion in the hip, no pain. May 1, 1912, patient wrote that her hip is getting stronger and that she scarcely limps. She walks around the house without even a cane. She can button her shoe easily when placing her foot on a chair, showing what good flexion she has in her hip (Figs 12, 13, 14 and 15).

CASE III—Mrs E. T., aged 46, entered hospital on account of inability to move right hip. Present trouble began in March eighteen years ago (1894). Weather at that time was extremely cold, and patient wore a warm seal coat which extended to the hips, while the lower garments were uncomfortably cool. Every time patient went out she felt very chilly from the hips down. This continued for two weeks, and one day when patient felt unusually cold, she complained of a soreness in region of the right hip. The pain increased in severity toward evening and at 8 P.M. it was excruciating and was localized over the hip-joint. The next morning she had a high fever, which continued for several weeks. For two weeks following the onset of the fever she retained complete function in the right hip, but complained of sharp pain in hip on attempted motion. For the next four months patient suffered a nervous breakdown, and has recollection of nothing, but knows she had pains all over her body. At the end of this time patient was unable to move thigh at hip and has been unable to do so since. At present has no pain in hip. Leg is apparently shortened, and she can neither flex nor extend thigh, neither has she lateral mobility.

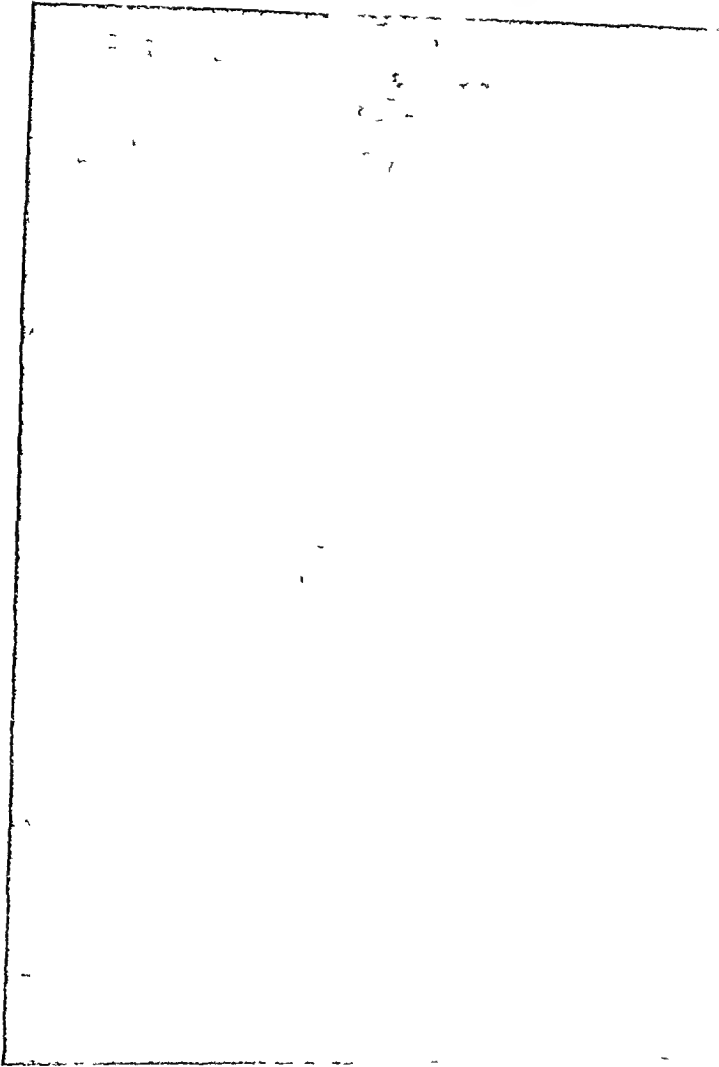
Examination shows that the leg is straight, about three-fourths of an inch shorter than its fellow. The hip-joint is stiff. The skiagram shows that there is a bony ankylosis, but it does not appear to involve all of the head of the femur (Fig 16).

*Operation* (December 5, 1912) —The usual arthroplasty was done. The U-shaped incision was made. Trochanter divided with chain saw and retracted out of field. The ankylosis was complete, *i.e.*, only the upper three-fourths of the head of the femur was involved in a bony ankylosis, the lower one-third in a fibrous ankylosis. The ankylosis was freed with a curved chisel, the normal conformation of the acetabulum and head of the femur was restored with the reamer and end mill. A flap of fat and fascia was dissected free from the under surface of the U-shaped skin flap and interposed between the acetabulum and head of the bone and sutured to the margin of the acetabulum and the remnant of the capsule on the neck of the bone. The trochanter was nailed back in place.

The wound was closed and the hip dressed in the usual manner. The patient was placed in the travois splint with a Buck's extension and a 25-pound weight attached on the leg.

Stitches were removed after four weeks (Fig. 17). Primary healing. Good motion in hip. When the patient left the hospital seven weeks after the operation she had normal motion in the hip and she could bear her full weight on the leg. She could swing her leg freely in all directions—in fact, it was impossible to detect which hip had been operated on (Figs 18 and 19).

CASE IV.—Mrs. A. C., aged 37, had all of the childhood diseases. Pneumonia at eight years of age. No typhoid, scarlet fever or diphtheria, no rheumatism. Jaundice seven years ago, lasting three weeks. Confined to bed for one week with nausea and occasional vomiting. Fever but no chill. Cannot remember having any pain during attack. Entire body was very yellow. Jaundice gradual in onset, reaching its acme and then disappearing gradually. Thinks fever, nausea and vomiting came on before she noticed jaundice. This was only attack she has ever had. Has had frequent attacks of tonsillitis since childhood. Has often had her tonsils incised for peritonsillar abscesses. Attacks have not been so severe during past three years, but tonsils always swell when she has a cold. No history of middle-ear disease, alveolar abscess, sinus infections. Spider bite on left leg seven years ago, followed by swelling of leg, lasting about six weeks, during which time she could not walk on it. No previous operations or injuries.



Case III Ankylosis of right hip of 18 year old male. The head of the femur were firmly united with the acetabulum and third the ankylosis was fibrous. The leg is stiff.

TABLE 2—SEPARATION OF MESENTERY WITHOUT TAPES ON DEVASCULARIZED SEGMENT

No of Dog	Number of Inches of Intestine Devascularized and Operative Notes	Post-operative Notes	Length of Life after Operation	Post-mortem Notes
3	Two inches Omentum wrapped around segment and sutured	Dog looked sick day after operation, recovered and was better until two days before death, no food	Died 27 days after operation	Dog much emaciated, no free fluid in abdomen, segment adherent and in a partial volvulus causing mechanical obstruction, segment well nourished, intestine above segment dilated and filled with hair for about two inches
6	Two inches Omentum wrapped around segment and sutured	Dog did well, never very sick, no food	Killed 22 days after operation	Dog much emaciated, segment very adherent, bowel proximal to segment dilated and contained fecal matter, distal bowel contracted, but contained fecal matter also, segment dilated very thin, but no perforation
7	Two inches Omentum wrapped around segment and sutured	Dog never appeared sick, no food	Killed 21 days after operation	Dog fairly well nourished, segment buried in mass of adherent omentum and mesentery, segment well nourished, no evidence of obstruction
9	Four and a half inches Omentum wrapped around segment and sutured	Dog never very sick, no food for eight days, then food given freely for ten days	Killed 18 days after operation	Dog in fair condition, omentum adherent to segment, otherwise there were few adhesions, vessels in adherent omentum much enlarged, nutrition of segment apparently normal, no evidence of obstruction
10	Four inches Omentum wrapped around segment and sutured	Dog never very sick, no food for five days, then food given freely for ten days	Killed 15 days after operation	Dog in fair condition, omentum adherent to segment, otherwise very few adhesions, vessels in adherent omentum were enlarged, nutrition of segment good, no evidence of obstruction
11	Five inches Omentum wrapped around intestine and sutured beyond borders of devascularized segment	Food and water given following day and until dog died	Died 28 days after operation	Dog emaciated weight about same as at operation. Omentum adherent over devascularized segment. No distention or obstruction at any point. Vessels of adherent omentum enlarged. Cause of death not ascertained. Nutrition of segment apparently good.
12	Four and a half inches Omentum wrapped around intestine and sutured beyond borders of devascularized segment	Food and water given following day and until dog was killed. Recovery uneventful.	Killed 49 days after operation	Dog in excellent condition—had gained in weight. Omentum densely adherent to segment. No obstruction. Vessels of adherent omentum enlarged as shown in specimen and photographs.

FIG 18



FIG 19



FIGS 18 and 19 —Case III Photographs taken seven weeks after operation. Patient had a splendid range of motion in the joint but was not permitted to go without crutches



FIG 18

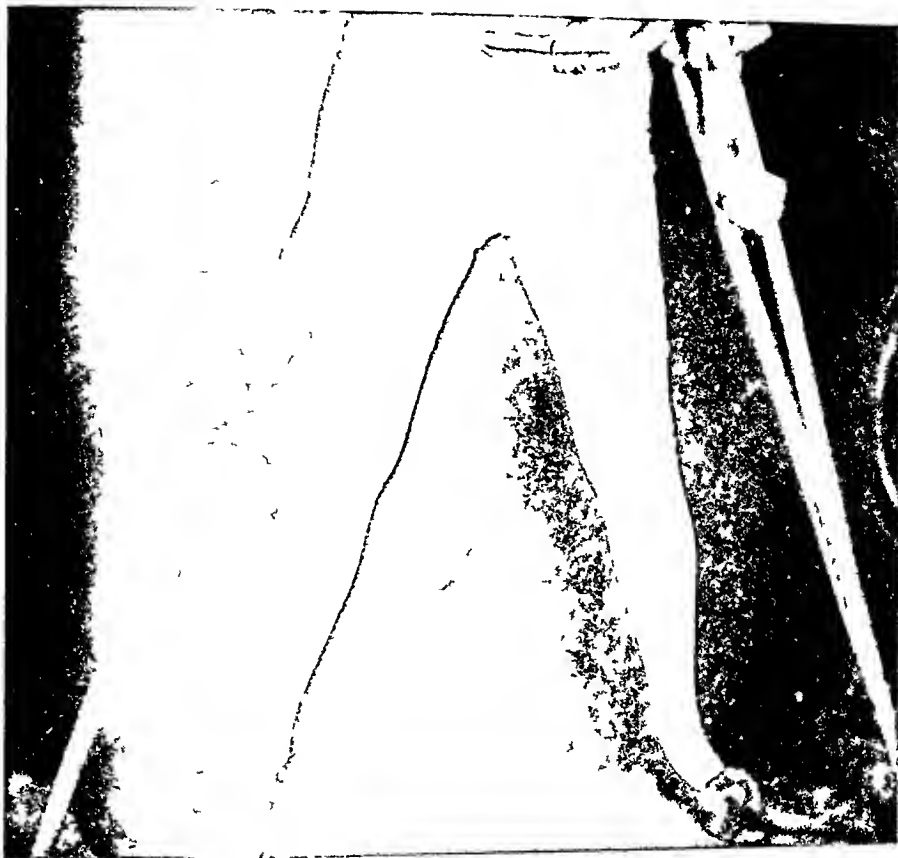


FIG 19



FIGS 18 and 19 — Case III. Photographs taken on 10/10/1917. The patient had a splendid range of motion in the joint, but was unable to perform









DR ALFRED S TAYLOR said he had used the method in a case of œdema of the lower eyelid resulting from a scar which extended from the ear to the nose. In this case, two or three strands of ordinary floss silk were passed, and after five or six weeks the œdema, which was very disfiguring, had largely disappeared and the improvement was permanent.

#### RESECTION OF THE PYLORUS (ULCER-BEARING AREA)

DR WILLY MEYER presented a man, 49 years old, who gave a history of typhoid fever six years ago, followed for two years by persistent constipation. Subsequent to this he complained of pain in the region of the hepatic curvature, of the colon, with occasional nausea and vomiting. Blood had been noticed in the stools.

Upon examination, there was distinct tenderness in the region of the gall-bladder and somewhat below that point. The case was regarded as one of duodenal or pyloric ulcer—possibly a malignant condition of the colon at the hepatic curvature, as the patient had recently lost about ten pounds in weight, or else an affection of the gall-bladder. The stomach examination was absolutely negative. The liver was somewhat enlarged.

On December 4, 1912, Dr Meyer opened the abdomen, making a right rectus incision, and revealing a picture which was somewhat unique. There was a hard circular ring, the size of the little finger, which surrounded the region somewhat distal to the pylorus without encroaching on the lumen of the duodenum and which was firmly adherent to the entire length of the gall-bladder. In view of the doubtful character of the growth, a complete resection of the pylorus was done, followed by a gastro-enterostomy. The patient made an uneventful recovery from the operation. Since then he had gained in weight and the result thus far was very gratifying.

According to the rules of the committee for the investigation of gastric ulcer, which has been formed in conjunction with that in Germany the specimen removed was submitted to Dr James A Ewing, of Cornell University who reported that it was an ulcer of the duodenum showing pathological evidence of pre-cancerous changes.

DR SYMS said he agreed with Dr Meyer that the importance of doing a radical operation in cases of so-called benign

ankylosis was broken up. It broke so suddenly that the doctor thought the bone had been fractured. The leg was put in a plaster cast extending from above the hip-joint to the ankle. This cast was left on for eight weeks and when it was removed the hip was as stiff as before. A skiagram made then did not show fracture, and the joint seemed to be normal. Before breaking up the adhesions her knee was turned in and now it is straight forward.

Since November, 1910, until the present time the patient has been walking with the aid of a cane. She can put weight on leg if she does it carefully. If she walks a block she has pain in the leg. Taking a misstep or putting the foot suddenly on the ground gives her severe pain in the hip-joint. During the past year she has not had chills or fever, cough or night sweats, no loss of weight. General health is good.

*Examination*—The patient walks with a cane. The left leg is fixed at the hip and is adducted beyond the pelvic inlet. There is no motion in the left hip-joint. The skiagram shows a bony ankylosis between the femur and the acetabulum (Fig 20).

*Operation*—After the usual preparation of the field of operation, a U-shaped incision was made with convexity downward, and surrounding the great trochanter. This U-shaped flap, including skin, subcutaneous fat and fascia lata, was dissected free and retracted upward. The anterior fibres of the gluteus medius were cut so as to give a good exposure of the joint. The great trochanter was sawed off with a chain saw, leaving its muscular attachments undisturbed. It was retracted upward. The capsule of the joint was then divided. On examination it was evident that the neck of the femur had been fractured but it had healed with fairly good apposition. There was a bony ankylosis of head of femur to acetabulum. This ankylosis was freed with a curved chisel, without much difficulty. The cavity of the acetabulum was prepared for the reception of the femoral head with a reamer and the head of the femur was rounded and shaped with a mill end. Having prepared the bones, the next step consisted in getting ready the interposing flap.

Fascia lata together with some of the subcutaneous fat was dissected off the lower surface of the U-shaped flap, swung into the new joint so as to cover the head of the bone, when it was replaced in the acetabulum and sutured around the head of the

FIG 20

Case IV Complete bony ankylosis of left hip with rotation of leg inward and adduction beyond pelvic inlet

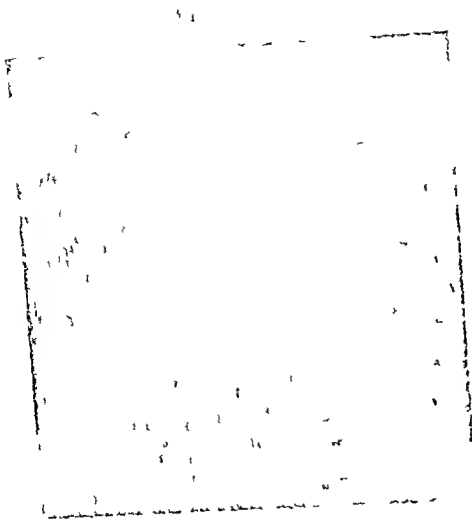


FIG 22



FIG 23



21, 22 and 23 —Case IV. Photographs made one year after operation showing that patient has a full normal range of motion in the position in which the arthroplasty was done.

femur to the remnants of the capsule on the neck with the phospho-bronze wire. The head of the femur was then replaced in the acetabulum. The great trochanter, together with its muscular attachments, was then replaced in position and secured with a wire nail driven through it into the shaft of the bone. The deeper layers of the wound were approximated with catgut. Silkworm-gut and horsehair were used to complete the closure. No drain. Incision was sealed with collodion strips. A large dressing was applied and the patient was placed in a travois splint with both legs abducted.

The patient made an excellent recovery from the operation, without any untoward symptoms. The first dressing was made after four weeks. Primary union. Stitches removed. Patient left the hospital sooner than was desired, but with some motion in the hip. One year after the operation, she wrote that she had such good motion in the joint that she did not know it had ever been stiff. She sent photos to show us what she could do. She has full flexion and abduction and walks without any support (Figs 21, 22 and 23).

**THE KNEE** — The knee is the most difficult joint in which to secure perfect restoration of function and restoration of nearly normal joint anatomy. The ankylosis must be relieved but the joint must be usable as well as movable, in other words, it is not sufficient to have the patient make extension and flexion of the leg while seated or standing, he must be able to bear his weight on the leg and to use it in locomotion without the assistance of cane or crutches. There must be no tendency to luxation in any direction and there must be sufficient firmness in the joint to permit of its free use. That means that the normal anatomic conformation of the joint must be restored as nearly as possible.

In the plan of reconstruction of the new joint I have adopted two courses. The first one, used in my original cases, was the implantation of the fascia lata and the vastus externus as the interposing tissue. The second plan, the one I follow to-day, is to implant two fat and fascia flaps, one lifted from the inner and the other from the outer aspect of the knee-joint.



The usual preparations for the operation are made. An Esmarch constrictor is placed around the thigh high up so as to secure real constriction. In my original operation I made a vertical incision just to the outer side of the patella, extending 4 inches above the joint and 3 inches below it. The wound margins were well retracted, so as to expose the field of operation. The patella was then freed from the femur with scalpel and chisel. Then a second vertical incision, only 4 inches long, however, was made to the inner side of the patella. Through this incision the freeing of the patella was completed from the inner side and the line of ankylosis was separated. The ligamentum patella was not divided, it was merely elevated and retracted to one side. The curved chisel was then used to separate the femur from the tibia on each side and every effort was made to restore the normal anatomic conformation of the joint surfaces. The curve of the chisel corresponded to the normal convexity of the condyles of the femur. If the ankylosis was bony and involved a considerable portion of the articular surface of the inner or outer condyle or both, the normal curvature of the condyles was reproduced. With a smaller curved chisel the corresponding tuberosity or both tuberosities of the tibia were restored by excavation, making the cavity deep enough to permit the extended leg to assume a straight position without putting tension on the popliteal structures or compressing the interposed flap and to restore the normal relationship of the femur and tibia as nearly as possible. Every effort is made to secure this end. The intercondylloid fossa and the intercondylloid ridge are reproduced, but in a slightly exaggerated degree, so as to insure stability of the new joint.

The next incision I adopted was the U-shaped incision. This incision is begun one inch above the highest level of the patella and one inch to the inner side. It extends downward and passes in a curving line about an inch below the patella to the outer side and then upward to a point opposite the commencement of the incision. The skin and fascia flap is then freed carefully so as not to buttonhole it. This flap also in-

cludes the superficial fat. The prepatellar bursa is not disturbed in any way. When this flap is lifted up the anterior surface of the knee-joint is exposed. The base of the flap is upward.

A pedicled flap was then made for interposition from the vastus externus or internus and swung down over the condyles, between them and the patella.

The normal conformation of the anterior surface of the femur must be preserved, in order that the patella may subsequently find its natural resting-place. Therefore, in doing the chiselling work, the chisel should be directed downward and inward toward the median line from both sides. The same chisels are used in this operation as in the hip arthroplasty, suiting the size and shape of the chisel to the work to be done.

Instead of using the fascia lata as before, I now take two lateral rectangular flaps, measuring  $2\frac{1}{2}$  inches in length and breadth, from the inner and outer side of the joint—the flap including capsule, ligament and subcutaneous fat. The base of each flap is directed downward, and is left attached to the base of the tuberosities of the tibia, just below the line of bone division to be made later. This flap must include all of the lateral capsule, fascia and fat, because they will serve as the interposing membrane to be placed between the freshened bony surfaces of the tibia and femur and prevent the recurrence of an ankylosis.

Of late I have reverted to the original incision of the skin, that is, the two parallel vertical incisions, one on either side of the patella. The reason for this change in technic was the fact that occasionally in the case of patients whose nutrition was not of the very best or where previous disease in and around the joint had lowered the vitality of the tissue, necrosis of the tip of the flap sometimes occurred. By making the two vertical incisions, we obviate the possibility of such recurrence of necrosis and we do not materially increase the difficulty of the operation.

One advantage, and by no means the least important one,

secured from this mode of approach to the joint, is the fact that the passive motion may be instituted sooner after the operation than when the U-shaped incision is made. The wound is less likely to be torn open and the flap less likely to be interfered with by attempts at flexion of the knee.

The patella has been handled in four different ways. 1 By using an interposing flap from the vastus externus or vastus internus to prevent union of the under surface of the patella with the femur.

2 Splitting it into two parts from above downward, and then turning the upper half under the lower half, so that the smooth fibrous aponeurotic surface came next to the femur, thus making it impossible for bony union to take place.

3 Freeing the vastus externus and internus attachments to the quadriceps tendon for a distance of 2 inches above the patella, next dislocating the patella from side to side during the operation, when the limb is straightened out and the interposing flap is in position the patella is separated from the overlying skin and fat by a blunt scissors spreading dissection extending upward over the quadriceps and downward over the ligamentum patella to its attachment, a 180° rotation of the patella is made, so that the upper surface or bursal side of the patella now becomes its articular surface and the prepatellar bursa aids in making a lining for the new joint. The upper surface of the patella is now trimmed down with a bone-cutting forceps until it is smooth and level. The vastus externus and internus are now sutured to the opposite sides of the quadriceps tendon from which they were freed, to prevent luxation of the patella and a return to its former position.

4 Covering the under surface of the patella and the entire articular surface of the femur with a fascial graft detached from the trochanteric zone of the fascia lata, without rotation of the patella.

I have had good results with all these methods. The rotation, however, is the simplest one and after operation gives an additional leverage to the quadriceps tendon. It has some disadvantages, as it supports the vitality of the skin flaps

Since adopting this plan, I have encountered cases in which so many operations had been performed about the knee-joint that even the capsular flap could not be secured in the adjoining tissues. Then I resorted to the final or third means for securing the interposing flap. After denuding the bone and freshening its surfaces, molding them, removing as much bone as was necessary of the upper end of the tibia or lower end of the femur to completely extend the limb, I took a portion of fascia lata and trochanteric bursa with the overlying flap of fat, measuring  $3\frac{1}{2}$  by 5 inches, from the patient's hip and interposed it *en masse*, in the knee-joint, sutured it first to the posterior condyloid portion of the capsule, second, brought it clear over the anterior surface of the femur and lower surface of the patella, third, accurately sutured it on both sides, and both ends, so that it covered all of the lower end of the femur and prevented bony contact of either the patella or tibia with the femur.

Having made the skin incision as described, exposed the joint, made the flaps and separated the patella from its attachment to the femur, we are now ready to sever whatever ankylosis may exist between the femur and the tibia. This is also done by means of a carpenter's or cabinetmaker's chisel, using both grooved and straight, as may be necessary.

The points to be observed at this stage of the operation are: 1. The normal conformation of the articular surface of both the tibia and the femur must be reproduced as nearly as possible, so that luxation of the joint will be prevented. 2. These surfaces must be so fashioned that the leg is strictly plumb. 3. Sufficient bony tissue must be removed so that the pressure brought to bear on the interposing tissue flap when the limb is straight will not be great enough to cause pressure necrosis.

It is not always necessary to change the conformation of the articular surface of these bones, because the ankylosis in the case may have been limited to a bony union between femur and patella. As a rule, however, most of these cases are of long standing, and there is always some bony union between

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powdered with bismuth subiodide, a collodion dressing is applied, with a 5 per cent moist phenol gauze over this, and then the usual dry dressing. A Buck's extension with a 12-pound weight is attached to the leg and is worn continuously to reduce the interarticular pressure, and thus prevent necrosis of the flaps, and to maintain the limb in a straight position. The limb is placed in a wire cage trough splint. Passive and active motion are begun, as after the hip operation. When these patients become ambulant, we apply a laced leather splint or legging, reaching from the groin to the ankle. This splint is patterned after the plaster mold of the leg, so as to secure an accurate fit and give the needed support to the knee. To favor increased flexion of the limb, the patient bends the knee passively and uses a machine to force flexion and extension, made by Knoke and Dressler, of Dresden, Germany.

#### ANKYLOSIS OF KNEE RESULT OF PHARYNGEAL INFECTION.

CASE V—Mrs V. N, aged 37, was admitted to Mercy Hospital August 25, 1911. Family history. Mother died of tuberculosis at 45, also two brothers. Father died of paralysis at 73. In 1900, the patient had a pelvic abscess which ruptured through the rectum. As long as she can remember she has had peritonsillar abscesses and sore throat with high temperature nearly every year. Has not had an attack the past two years.

September 1, 1897, she began to have attacks of pharyngitis, but does not remember anything about the duration or severity of the infection. Had a series of attacks, and with them extreme swelling of the right wrist-joint and fingers of the right hand. Hand was very painful, swollen and could not be used. Had a severe attack of tonsillitis lasting two weeks with peritonsillar abscess. Was in bed until November 15, when she had a similar attack in the right knee and thinks it was more severe. The condition of the wrist and fingers improved. With the second attack, temperature was very high, she was delirious. A history of chill is indefinite. She could not move the knee, or bear any pressure, even of bedding.

In January, 1898, she felt somewhat better. The knee-joint was painful only on motion and was tender to touch. Swelling had disappeared almost entirely. The knee now became stiff and

all the bones of the joint. A good fit should be secured between the intercondyloid notch of the femur and the intercondyloid ridge and tubercle of the tibia, because it is only by the accomplishment of this that the femur can be steadied and luxation of the tibia prevented.

It is at this stage of the operation that the interposing flaps are placed in position. These flaps are drawn inward, one from either side of the joint, over the head of the tibia, and are accurately sutured to each other over the intercondyloid ridge, a few stitches on the anterior edge securing the flaps to the base of the ligamentum patella. The posterior margin of each flap is sutured to the posterior wall of the capsule—which, it will be remembered, has not been disturbed at any stage of the operation. The object in view is to fix these flaps permanently on the articular surface of the tibia, so that every part of the freshened bony surface is covered by this tissue. The suture material used is phosphor-bronze wire for the deeper sutures and chromicized catgut for the periarticular sutures.

It is now that the work on the patella is done as described above. If the knee has been flexed to a considerable degree for a long period of time, it may be necessary to shorten the quadriceps tendon. This tendon is vital to the motion of the joint. The patella, on the other hand, is of less importance—in fact, I have been able to demonstrate time and again that it may be removed entirely and yet a splendid result may be obtained.

It is not always necessary to rotate the patella, except when ankylosis is apt to recur. As a rule, however, I rotate the patella as described above, suture the vastus muscles in place, remove the constrictor and close the wound. This closure is the same as that described in the operation on the hip.

As stated, the results in the knee are more difficult to secure than in any other joint. This is so because the knee-joint must be mechanically perfect and plumb, so that it may be freely movable, without causing any pain or discomfort.

The wound is closed without drain. The skin is freely

powdered with bismuth subiodide, a collodion dressing is applied, with a 5 per cent moist phenol gauze over this, and then the usual dry dressing. A Buck's extension with a 12-pound weight is attached to the leg and is worn continuously to reduce the interarticular pressure, and thus prevent necrosis of the flaps, and to maintain the limb in a straight position. The limb is placed in a wire cage trough splint. Passive and active motion are begun, as after the hip operation. When these patients become ambulant, we apply a laced leather splint or legging, reaching from the groin to the ankle. This splint is patterned after the plaster mold of the leg, so as to secure an accurate fit and give the needed support to the knee. To favor increased flexion of the limb, the patient bends the knee passively and uses a machine to force flexion and extension, made by Knoke and Dressler, of Dresden, Germany.

#### ANKYLOSIS OF KNEE RESULT OF PHARYNGEAL INFECTION.

CASE V—Mrs V N, aged 37, was admitted to Mercy Hospital August 25, 1911. Family history. Mother died of tuberculosis at 45, also two brothers. Father died of paralysis at 73. In 1900, the patient had a pelvic abscess which ruptured through the rectum. As long as she can remember she has had peritonsillar abscesses and sore throat with high temperature nearly every year. Has not had an attack the past two years.

September 1, 1897, she began to have attacks of pharyngitis, but does not remember anything about the duration or severity of the infection. Had a series of attacks, and with them extreme swelling of the right wrist-joint and fingers of the right hand. Hand was very painful, swollen and could not be used. Had a severe attack of tonsillitis lasting two weeks with peritonsillar abscess. Was in bed until November 15, when she had a similar attack in the right knee and thinks it was more severe. The condition of the wrist and fingers improved. With the second attack, temperature was very high, she was delirious. A history of chill is indefinite. She could not move the knee, or bear any pressure, even of bedding.

In January, 1898, she felt somewhat better. The knee-joint was painful only on motion and was tender to touch. Swelling had disappeared almost entirely. The knee now became stiff and



the contraction of the flexors of the thigh began and continued until the present time. The leg is flexed at about an acute angle (Figs 26, 27 and 28)

*Examination*—The skiagram showed a bony ankylosis of the tibia and femur and of the patella and femur. This ankylosis undoubtedly was the result of a metastatic arthritis from her pharyngeal infection (Fig 24).

*Treatment*—A transverse incision was made to expose the knee-joint. The patella was chiselled free from the femur and dislocated outward, leaving the quadriceps tendon and the tendon patellæ attached. A portion of the vastus externus was detached so as to allow the outward luxation of the patella. Two lateral interposing flaps were then prepared and the tibia chiselled free from the external condyle first and the internal condyle next, maintaining the natural conformation of the femoral condyles. Five-eighths of an inch of the upper end of the tibia was then removed, together with the semilunar cartilages, and the natural conformation of the articular surface of the upper end of the tibia was then secured with a curved chisel. An intercondylloid ridge and spine was maintained in an exaggerated degree. The osseous deposits over the articular surfaces of the condyle were then removed and a full normal anatomic conformation of the femoral condyles was reproduced with a chisel. The lateral flaps were interposed across the head of the tibia and sutured to the crucial ligaments and posterior portion of the capsule. The limb was then straightened out, the patella brought back to the mid-line and rotated 180 degrees, so as to place its bursa and fibrous capsule in contact with the articular surface of the femur. The vastus internus was sutured to the external margin of the rotated quadriceps tendon and the vastus externus was sutured to the internal margin of the rotated quadriceps tendon. The skin incision was then closed with horsehair sutures and without drain.

*Result*—Primary union followed. Motion was instituted in this case more rapidly than is usually done following arthroplasty, and the result is excellent (Fig 25). Sixteen months after the operation the patient had full extension and complete voluntary flexion of the leg (Figs 29, 30 and 31).

One year after the operation the patient wrote that she had splendid motion in the knee, that she did not limp, could climb stairs, and had a strong joint with full voluntary motion.

FIG 29



FIG 30



FIG 31



FIGS 29 30 and 31 —Case V. Photographs made 16 months after the operation. The patient had a normal range of motion in the knee and walked (stood a step) and at this time flex her leg so that the heel touched the buttock.

FIG 27

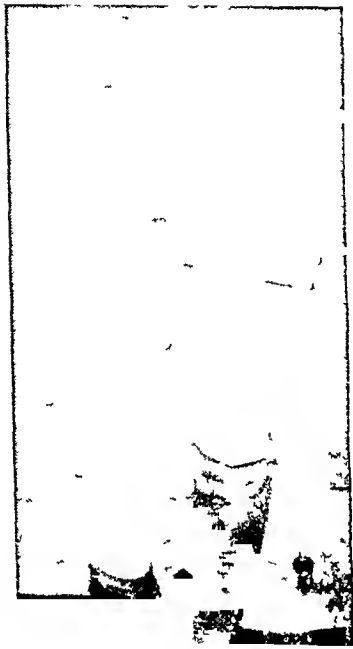


FIG 26



FIG 28



FIGS 26, 27 and 28 — Case V. Photographs made before operation showing position of leg and the very limited range of motion.

FIG 29

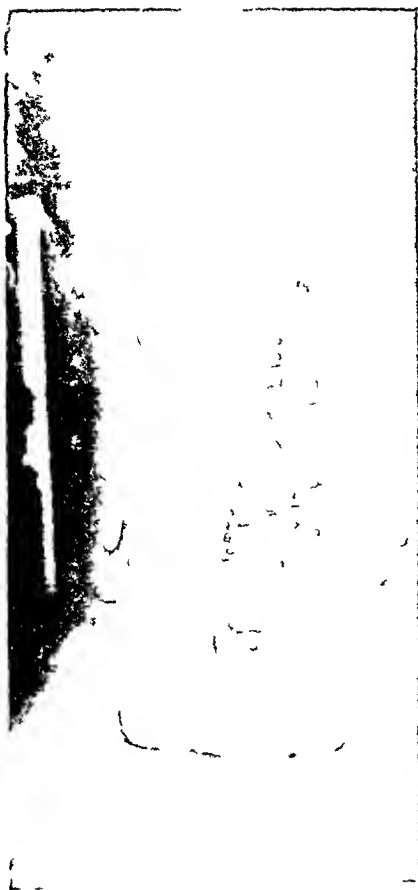


FIG 30

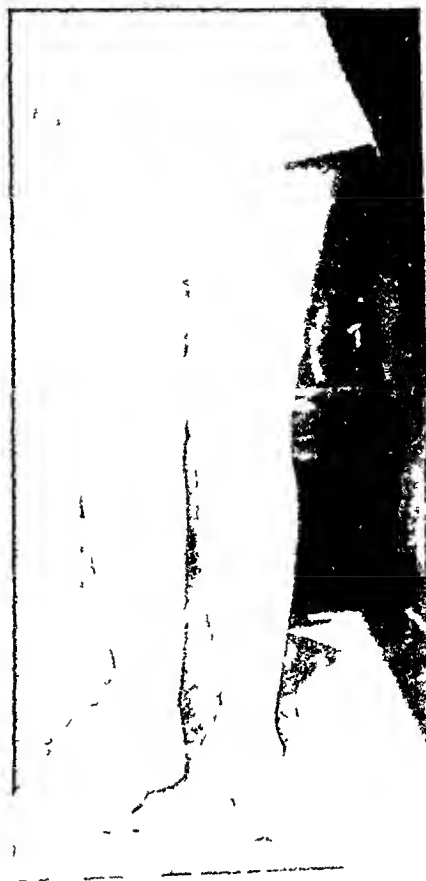


FIG 31



FIGS 29, 30 and 31 — Case V. Proctographs made 16 months after operation. At this time the patient had a normal range of motion in the knee and hip and was able to stand on her feet. She could at this time flex her leg so that the heel touched the buttock.



Case VI. Complete bony ankylosis of right knee of 30 years standing involving all the bony parts of the joint. Leg in acute flexion with curving backward of lower end of femur and contraction of nerves, vessels, muscles and tendons.

FIG 33

FIG 34



FIGS 33 and 34 —Case VI. Skiagram made about three months after operation. The leg is straight. The joint anatomy has been restored. The patella was turned turtle. The phosphor bronze wire sutures are in the soft parts and in the interposed flaps. The fibula is higher than normal because of the bone removed from the upper surface of the tibia.

## ANKYLOSIS OF KNEE RESULT OF TRAUMA

CASE VI—Miss L P, aged 37, was admitted to Mercy Hospital November 2, 1911 Family History Father died of carcinoma of stomach The patient had had the ordinary diseases of childhood with occasional attacks of tonsillitis up to two years ago

Thirty years ago she fell and struck her right knee against fence rail Thinks she walked home but does not remember definitely Doctor examined the knee at once and gave her some liniment to apply Had no chills or fever and was not in bed Walked to school after that every day, a distance of about one mile, but limped and walked on toes and ball of foot because of pain when she straightened the limb Five years after the first injury she again fell and struck her right knee on the ground She had considerable pain after this and the knee became more and more flexed Shortly afterward she was taken to the hospital, was anæsthetized and leg straightened A brace was applied but caused so much pain that it had to be removed After this the knee began to flex again and continued to do so until it reached its present position, sixteen years ago, since which time it has remained as it is Does not remember ever having chills, fever, nausea or vomiting Neither was leg swollen until after the second injury and then only slightly There has been no discharge from the knee Her general health is good

*Examination*—The knee is firmly fixed at an angle of 60 degrees The downward curve in the lower end of the femur is very evident on palpation and inspection The patient wears an artificial leg and foot attached to her flexed leg and foot so as to be able to walk without crutches The skiagram shows a complete bony ankylosis of the knee with the leg at an acute angle with the thigh with a marked bowing of the lower end of the femur (Figs 32, 35 and 36)

*Treatment*—An incision was made over the hamstring muscles of the outer and inner sides of the right leg Both hamstrings were split and elongated 3 inches A transverse incision was made just below the patella extending down to the patellar ligament, retaining most of the fat and fascia with the skin-flap The interposing flap was taken almost entirely from the vastus externus muscle and the external portion of the

injections The latter are more accurate than the opaque ureteral catheter, especially in establishing the diagnosis of multiple ureters and pelves In horseshoe kidney and irregular varieties of double kidney of a congenital type, in the congenital single kidney (more rare than horseshoe kidney) and in the single kidney with atrophy or destruction of the other through disease we have conditions which tax the diagnostic ability of the surgeon to the utmost The lesson we must learn then in every case in which we are not positive of the condition, is always to explore the other kidney, usually through a separate incision, before removal of a tumor or a diseased kidney, and in abdominal surgery in which tumors of unknown type and origin are discovered, regardless of location, the kidneys should be palpated before the removal of the tumor

*Operation* —In some instances the incision will be a transperitoneal one The lateral incision described by W J Mayo<sup>19</sup> will suffice in most cases It is as follows

“Beginning at a point two to two and one-half inches lateral to the dorsal spines near the outer margin of the erector spinæ muscle, a longitudinal incision is made two or three inches in length through the skin, superficial fascia and posterior layer of the lumbodorsal fascia (vertebral aponeurosis) which covers the erector spinæ muscle The incision lies behind the twelfth rib from the angle, if present, nearly to the head, and reaches downward to a point one-half inch below the angle From this point the incision passes obliquely downward and forward along the anterior margin of the quadratus lumborum muscle to a point an inch above the crest of the ilium, and there turning runs forward parallel to the iliac crest as far as necessary

“The posterior superior lumbar triangle (Kelly) just beneath the twelfth rib is then exposed by cutting an opening through the external and internal oblique, transversalis, and latissimus dorsi muscles, exposing the transversalis fascia in its lumbar portion This fascia is then opened freely, exposing the perirenal fat The ilio-inguinal and iliohypogastric nerves are identified and retracted out of harm's

FIG 35

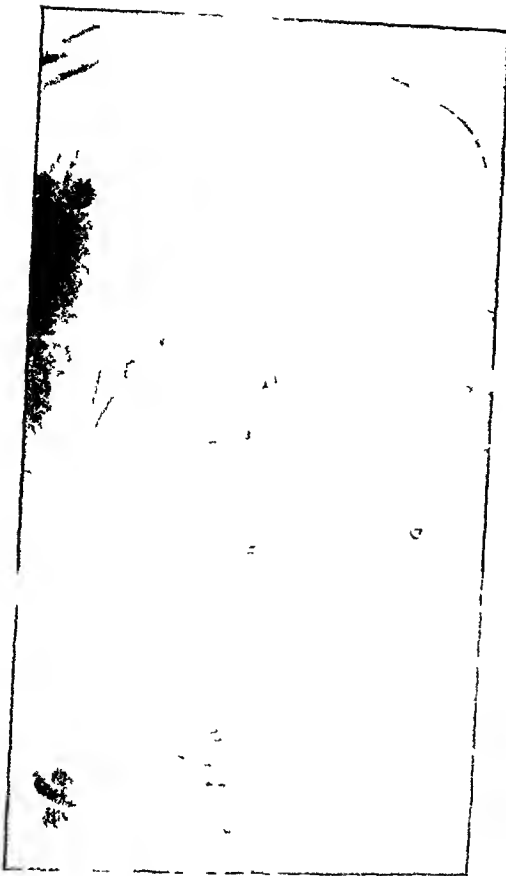


FIG 36



FIGS 35 and 36—Case VI Photographs made before operation showing the fixed position of the leg in acute flexion and the artificial leg the patient wore to enable her to walk without cane or crutches

FIG 37



FIG 38



FIGS 37 and 38—Case VI Photographs made after operation showing the leg is almost straight with a range of motion of about 20 degrees. The patient can now bear her full weight on the leg and walked with a cane



capsule. The patella was chiselled loose from the femur, leaving it attached to its ligament and tendon above and below. There was a firm bony ankylosis between the femur and the tibia. This was chiselled loose and an effort made to straighten the limb. It was then noticed that there was a bony protuberance on the inner condylloid ridge posteriorly pressing on the vessels. This protuberance was chiselled off and then the limb could be straightened without compressing the popliteal vessels or nerves. These structures were exposed clearly to view but not injured during the operation. After removing an inch and a half of the tibia and one-half inch of the fibula, the limb could be brought almost to a straight line or about 160 degrees, this being considered a most desirable angle. The normal concavities on the upper end of the tibia and the intercondylloid ridge and spine were reproduced. The fibula was brought in as part of the articular surface. The interposing flap was sutured over the end of the tibia. The patella was turned turtle and united by suture with the vasti muscles in the usual way. The wound was closed without drainage.

*Result*—There was considerable tension on the vessels and nerves when the limb was straightened, and we had some apprehension of the maintenance of the circulation. That afternoon the foot was warm, but a little cyanotic. There was voluntary motion in the extensors and flexors. The following morning the foot was completely numb, quite œdematous, and all motion and sensation had disappeared. There was no pressure from the cast. It was the elongation of the vessels and nerves which had caused this œdema and paralysis. Within twenty-four hours the cyanosis had disappeared and in another twenty-four hours the œdema and swelling subsided, but sensation and motion were still absent. Following this the limb went through a progressive but complete healing at the knee, and sensation returned completely, motion becoming progressively better. There was a small decubitus ulcer on the heel, the result of absence of nerve transmission in the leg and failure of the patient to recognize it on account of the analgesia. The patient had suffered no pain in the heel. On March 9, 1912, the ulcerated surface was freshened, leaving a raw surface the size of a dollar. The mucous taken from a previous case of perineorrhaphy was implanted in strips over this raw surface. Traction sutures were inserted, passing

given three injections of a stock pyocyaneus vaccine and the discharge subsided entirely. The case went on to primary union

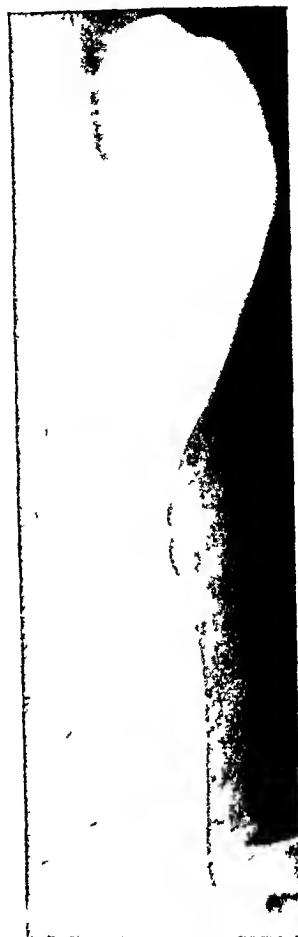
*Result*—She left the hospital four months after the operation, and at that time was able to put the limb through a great latitude of motion and practically without pain. Following her return home she had two attacks of suppuration from the trochanter. This was believed to be due to the iron nails. She came back to the hospital and the iron nails were removed. Primary union resulted and there was no return of manifestation of the infection (Figs 10 and 11). She walks with an elevation on the heel of her shoe of three-quarters of an inch. There is practically no limitation of motion in the hip; no pain. May 1, 1912, patient wrote that her hip is getting stronger and that she scarcely limps. She walks around the house without even a cane. She can button her shoe easily when placing her foot on a chair, showing what good flexion she has in her hip (Figs. 12, 13, 14 and 15).

CASE III—Mrs E T, aged 46, entered hospital on account of inability to move right hip. Present trouble began in March eighteen years ago (1894). Weather at that time was extremely cold, and patient wore a warm seal coat which extended to the hips, while the lower garments were uncomfortably cool. Every time patient went out she felt very chilly from the hips down. This continued for two weeks, and one day when patient felt unusually cold, she complained of a soreness in region of the right hip. The pain increased in severity toward evening and at 8 P.M. it was excruciating and was localized over the hip-joint. The next morning she had a high fever, which continued for several weeks. For two weeks following the onset of the fever she retained complete function in the right hip, but complained of sharp pain in hip on attempted motion. For the next four months patient suffered a nervous breakdown, and has recollection of nothing, but knows she had pains all over her body. At the end of this time patient was unable to move thigh at hip and has been unable to do so since. At present has no pain in hip. Leg is apparently shortened, and she can neither flex nor extend thigh, neither has she lateral mobility.

Examination shows that the leg is straight, about three-fourths of an inch shorter than its fellow. The hip-joint is stiff. The skiagram shows that there is a bony ankylosis, but it does not appear to involve all of the head of the femur (Fig. 16).

FIG 39

FIG 40



Case VII Ankylosis of left knee due to bony union between patella and femur and fixation of leg at an angle of 80 degrees

FIG 41

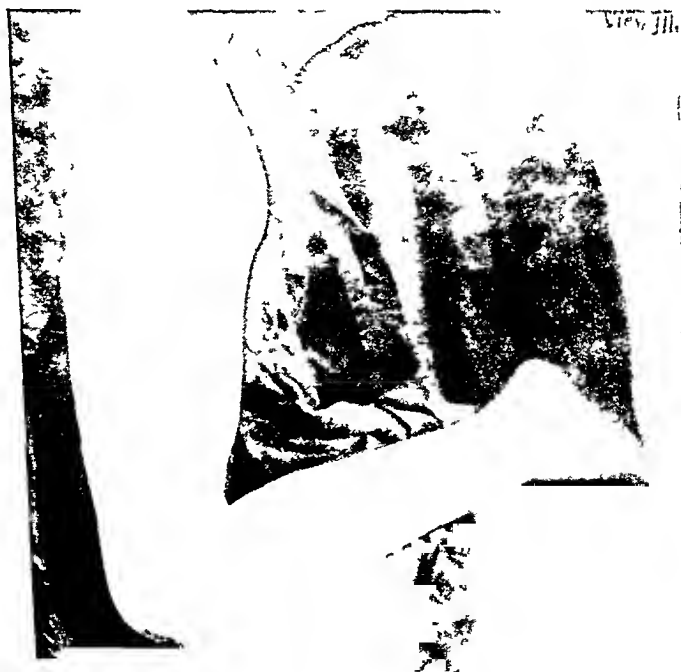


FIG 41



gradually subsided but the knee could not be flexed because of pain. She went home October 1 with a plaster mold extending from ankle to hip and the leg straight. Under massage the pain gradually disappeared, but the knee was stiff and the leg straight. March 1, 1908, adhesions were broken up and extension applied. Every third day the knee was bent forcibly without anæsthesia. She remained in the hospital five weeks, when the knee was straight and stiff. The joint gradually flexed again. July 16, knee was again bent under anæsthesia and that evening she had a slight fever and severe local pain. The knee was constantly under treatment with frequent attempts made to flex it. Each attempt was followed by fever and severe pain. About the middle of September the knee became flexed to its present extent and has remained so.

*Examination*—There was bony ankylosis of right knee with knee flexed at a bad angle, about 150 degrees with the thigh (Fig 42)

*Treatment*—Typical arthroplasty of the knee was done with a splitting operation of the patella. The external half of the patella was rotated 180 degrees so as to form the internal half. Primary union of the superficial and deep flaps resulted. Passive motion was resorted to early.

*Result*—This patient was able to walk and sustain the full weight on her limb five weeks and six days after the operation. She could flex the limb almost to right angles eight weeks after the operation. Since that time she has learned to flex the knee to an acute angle with the thigh and to extend it fully and voluntarily. She has no pain whatever on walking and the slight limp can scarcely be detected. She has one-third of an inch elevation on the heel of her shoe to compensate for the shortening. In the skiagram it can be seen that there is a close resemblance to the normal conformation in the operated joint, so that it is almost impossible to determine which was the knee operated on (Figs 43 and 44).

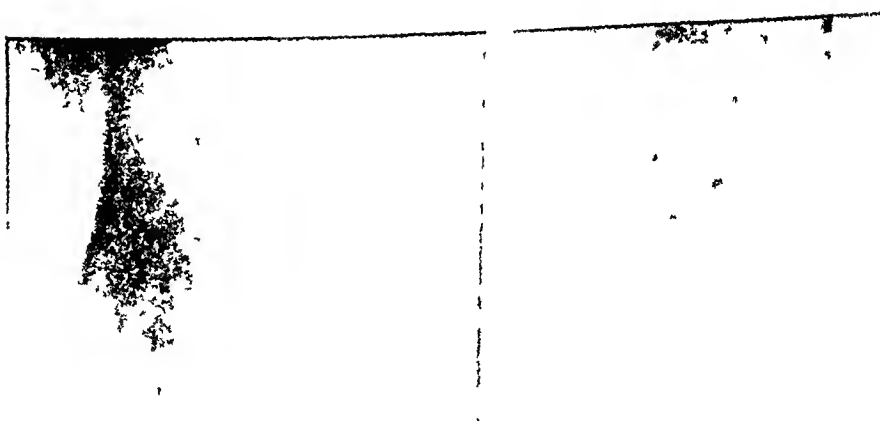
An interposing flap of tissue in this case consisted of fascia lata, with a thin layer of muscle removed from the outer surface of the vastus externus, the base being directed downward and slightly anterior. This flap was turned over the outer condyle of the femur, drawn through the joint between the femur, patella tibia by means of heavy catgut sutures which had been

Case VIII Comp  
right knee involving  
joint with the leg flex  
degrees

flexion of  
degrees of the  
angle of 150

Case VIII So  
one month after  
straight and the  
re-erect the  
fibular area

FIG 11



gradually subsided but the knee could not be flexed because of pain. She went home October 1 with a plaster mold extending from ankle to hip and the leg straight. Under massage the pain gradually disappeared, but the knee was stiff and the leg straight. March 1, 1908, adhesions were broken up and extension applied. Every third day the knee was bent forcibly without anæsthesia. She remained in the hospital five weeks, when the knee was straight and stiff. The joint gradually flexed again. July 16, knee was again bent under anæsthesia and that evening she had a slight fever and severe local pain. The knee was constantly under treatment with frequent attempts made to flex it. Each attempt was followed by fever and severe pain. About the middle of September the knee became flexed to its present extent and has remained so.

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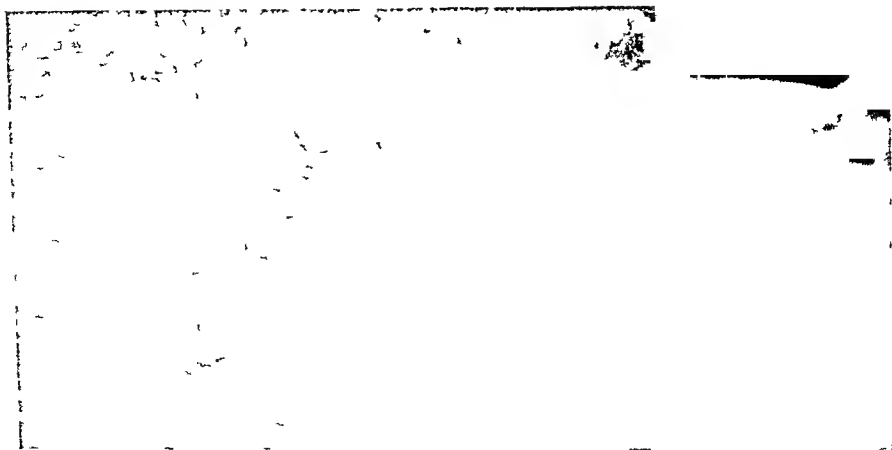
An interposing flap of tissue in this case consisted of fascia lata, with a thin layer of muscle removed from the outer surface of the vastus externus, the base being directed downward and slightly anterior. This flap was turned over the outer condyle of the femur, drawn through the joint between the femur, patella and tibia by means of heavy catgut sutures which had been

entirely over the wound and the implanted mucosa. The result was good. The wound healed over nicely. The patient left the hospital on May 2. She had full development of flexor motion in the leg muscles and extensor power was returning rapidly. The ulcer on the heel had healed almost entirely. There was a motion of 20 degrees in the knee-joint, but little power of extension, as her quadriceps muscle and tendon had been inactive for thirty years. It will require a long time to develop the quadriceps muscle (Figs 33-38).

CASE VII—Miss L. S., aged 28, admitted to Mercy Hospital October 11, 1907, because of ankylosis of left knee. Had measles in childhood and following this some gastrointestinal trouble lasting about a year. Has had several attacks of malarial fever, the last about six years ago. Had asthma between 1890 and 1894. In July, 1903, during menstrual period, was seized with a sudden severe pain in lower part of abdomen which required a hypodermic of morphine for relief. Flow stopped. Attack lasted a week. No referred pain. Had fever, but does not know how much. Pain ceased suddenly on the seventh day, and she was free from pain for one day, when she was seized with a sudden severe pain in the chest, of a stabbing character, involving both sides and back, breathing shallow and costal in character, no cough, some fever, unable to lie down and sat bolstered up in a chair. Morphine used but did not give relief. Pain remained in same locality and of same character for seven days, when it ceased suddenly.

In July, 1904, while in bed, she was seized with a severe stabbing pain in the left knee, so severe that she screamed in agony and was unable to get out of bed or to move left leg, which seemed paralyzed from the hip down. Physician said she had some fever. No chill at any time. Character of pain changed from stabbing to steady and severe, so that the patient could not sleep, except when exhausted. One month after the onset of this attack left shoulder, elbow, wrist and fingers became involved, and she was unable to move left arm voluntarily, but could move it with the aid of the other arm. Could not bend elbow or wrist. Elbow became swollen to twice normal size. Pain in shoulder, wrist, and fingers was intermittent in character, but pain in elbow was constant and much more severe.





Case VIII Photograph made just before the operation showing position of the leg  
The hip is not involved

FIG 47

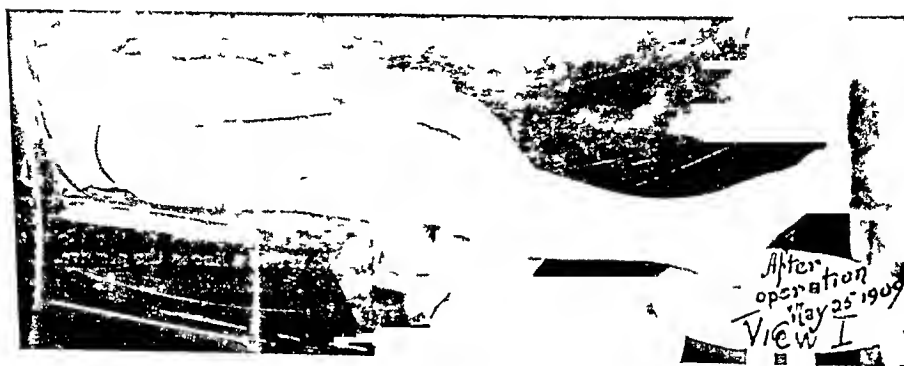
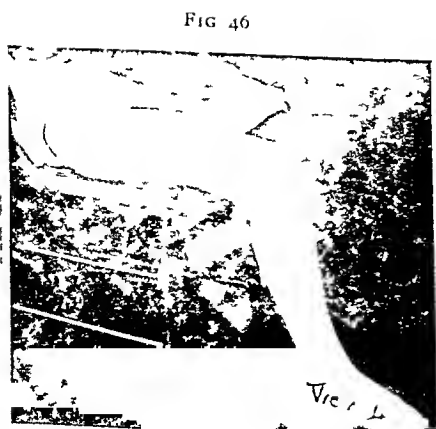


FIG 48



FIGS 46, 47 and 48—Case VIII Photographs made about five months after the operation. The patient had a normal range of motion in the joint and was able to walk without any assistance

juncture of the anterior with the transverse portion of the lower articular surface of the femur

*Result*—May 23, 1909, patient wrote that since she left Chicago, fourteen months before, she has had splendid use of the limb and could walk without any limp. On or about May 1, 1909, she slipped and fell on the injured knee, hurting it severely. She was lifted up but could bear no weight on her foot. The knee became very much swollen. On May 23, patient reported swelling gone but still had a good deal of soreness in the knee. This eventually disappeared and when last heard from she was improving all the time (Figs 40 and 41).

#### ANKYLOSIS OF KNEE RESULT OF INSECT BITE.

CASE VIII—Miss L. L., aged 21, was admitted to Mercy Hospital December 24, 1908. Her father died of carcinoma of stomach, family history was otherwise negative. She had had diphtheria, measles, pains in calf of legs and in arms during a cold which was called rheumatism.

In July, 1907, a finger of the right hand was infected while picking flowers. She thinks she was poisoned by an insect. The evening of the next day the finger was contracted and painful and during the night became swollen. She was awakened at 4 A. M. by severe pain radiating into the hand and forearm. At 9 A. M. the finger was much swollen. An incision was made and pus and dark blood were evacuated. A linseed poultice was then applied. At 8 P. M. pain was very severe and extended above the elbow. The swelling increased, extending into the shoulder, and she had severe pains in muscles in back of neck. She had high temperature (how high not stated). On the sixth day she was taken to the hospital. She was delirious part of the time. The infection extended to the muscles of the neck and lower jaw. She developed trismus. This condition continued for nine days, when improvement began. Four weeks later while walking she had a sudden severe pain in the knee-joint. She went to bed and the pain disappeared as suddenly as it came. It returned in the evening and the knee began to swell and redden. On the tenth day the joint was much swollen and flexed. Under anæsthesia, the leg was straightened and put in a tin splint. The infection in the finger and neck had subsided almost completely. September 1, the knee was opened under anæsthesia. The swelling

was gone. She got around for several days again, but the knee was tender and stiff, so she went to bed again. She kept the leg in a flexed position so long that it took several weeks to get it straight. August 1, 1911, she got up but used crutches. Pain in knee only when she jarred it. In September she took an anæsthetic and had the adhesions in the joint broken up. Remained in bed ten days. The knee was baked in the oven for one hour at 275–300 degrees, after which her doctor tried to bend it but got no more motion. Had about 50 degrees motion before that. December 15 she had a plaster cast made which she kept on three and one-half months. The swelling gradually disappeared. Knee now is only slightly larger than the other. Leg is straight. No motion in knee-joint. No pain. No sore throat, no history of infection anywhere.

*Examination*—The patient's right leg was straight and stiff without any motion whatever in the knee-joint. There was no thickening of the joint and no evidence of atrophy of the quadriceps muscle. The skiagram showed that there was bony union between the patella and the femur and between the tibia and the femur (Figs 49 and 50).

*Treatment*—The operation was done nineteen months after the onset of the trouble. After the usual preparation of the field of operation and with the constrictor placed high up on the thigh, two longitudinal incisions were made about 5 inches in length, one on either side of the patella, extending from 1 inch above and to the outer and inner side of the patella respectively, to two inches below the patella. These incisions extended down to the outer fibrous layer of the capsule. The patella was then chiselled free from the attachments to the femur by means of an ordinary carpenter's chisel and was retracted to the right or to the left, as was necessitated by the further steps of the operation. Two pedicled flaps were then dissected up, consisting of fat and fascia, the base being directed upward, one on the outer and one on the inner aspect of the joint. These flaps were then carefully displaced out of the field of operation, because they were to be interposed between the tibia and the femur to prevent recurrence of the ankylosis. By means of a large curved chisel the ankylosis between the tibia and the femur was then freed in the line of the joint and the normal conformation of the articular surface of the tibia was then restored by removing about

one-quarter of an inch of the upper end of the tibia. The depressions for the condyles of the femur and the intercondylar ridge and tubercle were fully restored, so that the leg was perfectly plumb. There was enough space between the tibia and femur to insure the vitality of the interposing flaps. The posterior portion of the capsule of the joint and the posterior crucial ligament were preserved so as to prevent the backward luxation of the tibia subsequently. The two interposing flaps were then drawn into the joint and overlapped, being sutured to the posterior capsule and crucial ligament behind and to the periosteum of the tibia laterally and in front with fine chromicized catgut, care being taken to cover every part of the bone so that the ankylosis could not recur. A small flap of fascia was then dissected up from the vastus externus, base upward, and slid under the patella so that the ankylosis between the patella and the femur could not recur. This was also sutured in place with a few chromicized catgut sutures. The constrictor was then taken off, but as is usual in these operations, there is so little hemorrhage that practically no ligation of vessels needs to be done. If there are any bleeding points they are ligated with plain catgut.

The wound was then closed with deep catgut sutures, the skin edges being approximated with horse hair. Bismuth subiodide and collodion gauze sealed the wound. The dressing consisted of moist 5 per cent phenol gauze. The leg was then placed in a wire trough and a Buck's extension with 15 pounds of weight attached. It will be noted that the patella was not turned turtle in this case as was done in some of the cases. We felt that the interposition of the soft tissue flaps between the patella and the femur would answer the purpose of preventing the recurrence of the ankylosis. The first dressing was made after four weeks, the wound had healed by primary union, the stitches were removed. The patient had a slight degree of voluntary motion in the joint. Passive motion and massage were then instituted and the patient was allowed to be up and around on crutches after six weeks. The Buck's extension with weight attached was put on every night. The patient left the hospital after twelve weeks with good voluntary extension of the leg and voluntary flexion to about 45 degrees. Unvoluntary passive flexion to right angles was easily accomplished. We have since

received word from the patient that her knee is improving every day. She has absolutely no pain or discomfort and can bear her full weight on the leg and can flex it better than a right angle (Figs 51 and 52)

CASE X—Miss J H, aged 15, was admitted to the hospital on December 29, 1911, with an ankylosis of the right knee. Previous to August, 1908, she was entirely well. At this time (August 3) she had two boils on her right forearm at the elbow. These boils discharged pus freely and were slow to heal. At noon, August 13, she had a very severe chill and at once went to bed. Twenty minutes later she vomited and her temperature rose to 103° F. Five hours later the right ankle, which she had sprained four months previously, with good recovery following, became very painful. In the morning the ankle and leg just above it were swollen and slightly red. The pain in the ankle subsided after 48 hours. Her temperature in the meantime had risen to 106° F, and she was delirious, remaining so for two days. Her temperature ranged from 102° to 104° F. Patient says that at this time there was an epidemic of furunculosis in her neighborhood.

On the third day following the initial symptoms in the right ankle the first phalanx of the third finger of the left hand began to pain, the pain being preceded by a chill and followed by elevation of temperature. The joint quickly became swollen and red. On the fifth day the right shoulder became painful and slightly swollen. This attack was also preceded by a chill and followed by a rise in temperature.

On the twelfth day the left shoulder was similarly affected, and one month later the right knee.

These multiple foci of infection were lanced as follows. First an incision was made half-way between the ankle and the knee, over the crest of the tibia. A considerable quantity of pus was evacuated. This wound drained for five months. Next the finger was incised (a month after the onset), pus was evacuated and small fragments of bone were removed. This incision closed within a week and the joint became ankylosed at once. A week later the right shoulder was incised and much pus evacuated. This wound drained eight months. Within a week the left houlder was lanced.

FIG 49

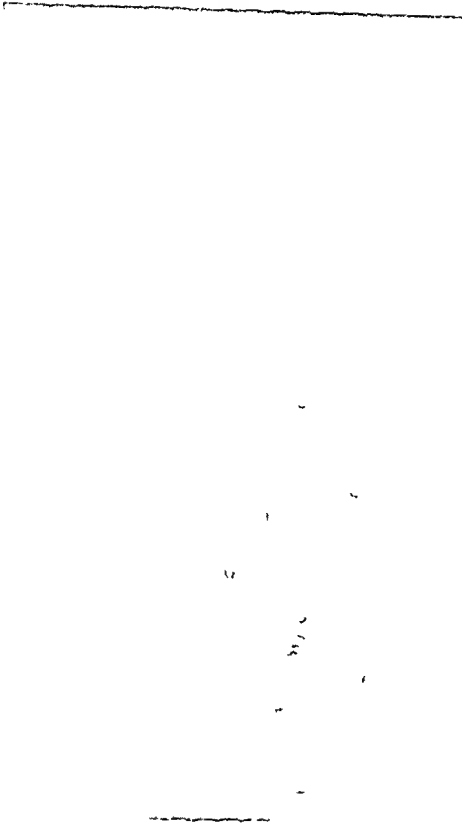
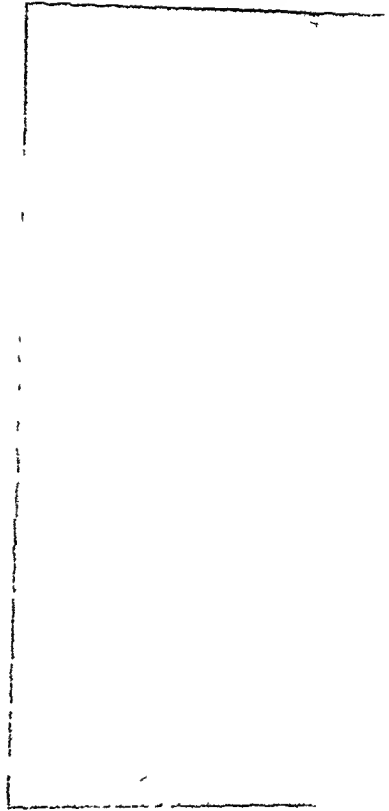


FIG 50



FIGS 49 and 50 — Case IX. Complete bony ankylosis of right knee involving all of the bones of the joint. The leg was straight. In the anteroposterior view it will be seen that the ankylosis extends the full width of the femur and tibia. In the lateral view the patella is seen firmly united with the femur.

FIG 51



FIG 52



FIGS 51 and 52 — Case IX. Skiagraphs made two months after operation. The joint cavity has been restored, the leg is plumb, and the patient able to walk. There is no motion of motion.

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April 1, 1910, eight months later, both shoulder joints were again opened and fragments of bone were removed from each. Both wounds discharged pus for seven months and then closed permanently. She has never had any trouble in either fingers or shoulder since.

The right knee became involved slowly. There was no chill preceding the onset of the trouble. It became slightly swollen and was not very much reddened at first. Later it became very painful and much swollen. Six weeks after the onset of the knee involvement an incision was made just below the patella and a large amount of serosanguineous fluid was removed. A second incision was made just above the ankle and much pus and small fragments of bone were discharged. This wound drained for eight months, healed, opened again, healed again, continuing in this way at intervals up to the present time.

A splint was placed on the knee before the ankle was incised and left on for four months. The knee was very painful for three months and intensely swollen. The swelling slowly subsided. The cast was removed in January, 1909, and the knee-joint was ankylosed.

Incisions have been made over the right tibia twice and each time particles of bone were removed. In October, 1911, one of these wounds opened and has been discharging pus ever since.

*Examination* (December 29, 1911) —There is a bony ankylosis of the right knee-joint. The patella is freely movable. There is a discharging sinus just below the patella (Fig 53).

January 16, 1912. All the sinuses have healed with good primary union, except for a small area just below the patella, where pus is still being discharged. The patient was advised to return home and appear for re-examination in the fall.

September 4, 1912. Patient returned with the sinus completely healed and ready for operation.

The leg was perfectly straight and stiff. The normal anatomy of the joint had been completely destroyed, but the patella was freely movable, there being no ankylosis between the patella and the femur. The early restoration of motion in the knee-joint after an arthroplasty depends on the degree of motility of the patella, and inasmuch as the leg must be kept quiet for some three or four weeks at least after the operation, there is always the possibility of having fibrous adhesions form.



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Case X Bony ankylosis of right knee involving femur and tibia only, the patella was free. The ankylosis extended the full width of the joint. The leg was straight.

FIG 54

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FIG 55

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FIGS 54 and 55—Case X. Skiagraphs made four months after the operation showing full restoration of the joint cavity and normal conformation of the femur and tibia.

margin for a distance of 4 inches, and elevated so as to expose the coracoid process with the attached heads of the biceps and coracobrachialis is divided about  $\frac{3}{4}$  inch from the tip and displaced outward. A curved chisel is then used to separate the bony union between the glenoid and the head of the humerus, and an additional excavation on the surface of the glenoid is made. An incision is then made at right angles to the original incision across the chest, over the middle of the pectoralis major muscle, a flap of fat, aponeurosis and pectoralis major muscle is then made,  $4\frac{1}{2}$  inches long and  $3\frac{1}{2}$  inches wide, with its pedicle left attached to the humerus. It is swung upward and interposed between the head of the humerus and glenoid, completely covering the bony surfaces. In lieu of this simple procedure, the following may be adopted, as described by Coville. He made a 4-inch incision, starting below the clavicle and passing external to the coracoid process, down along the arm, following the fibres of the deltoid muscle. This muscle is incised just outside of the deltopectoral groove, when the shoulder joint will be found to be exposed freely. Coville then extracted the head of the humerus and divided it from the remainder of the bone, at the level of the anatomic neck. The long strip of deltoid muscle was cut transversely, the superior portion being left adherent. A piece 4 inches wide was taken from the transverse section and interposed between the head of the bone and the glenoid cavity.

Coville perforated the capsule with a probe so as to prevent wounding the musculospiral nerve, and made a counter-incision at the same level, passing a thread through the opening. This thread surrounded the extremity of the muscular strip in the form of a loop, and by tightening this loop the strip of muscle is applied to the articular cavity.

Besides using a muscle-flap in the manner described above, one may substitute and use as an interposing flap the anterior portion of the deltoid, inserting it anterior to the coracobrachialis and short head of the biceps. The result in Coville's case was an excellent one. Three days after the operation

underneath the patella, which interfere with its mobility. We have long recognized this fact and after many experiments have finally concluded that in the next suitable case we would interpose a sheet of paraffin with a melting point of about  $123^{\circ}$  between the patella and the femur. That, of course, prevents the formation of adhesions as well as a recurrence of the ankylosis and would not interfere with the subsequent clinical course of the case. We believe that it will be a material factor in the early restoration of motion in the joint and a greater degree of motion than has heretofore been the case.

*Treatment*—The operation in this case was done in accordance with our usual procedure. Two longitudinal incisions were made, one on either side of the patella, but, inasmuch as the bony union between the tibia and femur extended across the entire articular surface, an entire new joint had to be made,—that is, both the tibia and the femur had to be restored to their normal conformation, which we did by means of the chisels we employ in this work. Two lateral flaps of fat and fascia were interposed, nothing, of course, being done to the patella. The wound was closed with catgut and horse hair and the knee dressed with phenol gauze. The leg was placed in a wire cage and a Buck's extension applied with 15 pounds of weight attached.

The result in this case was an excellent one. Two weeks and two days after the operation the patient had about 5 degrees of motion in the joint. Four weeks after the operation, when the stitches had been removed and healing of the skin wound was complete, the patient walked on crutches and could voluntarily extend the leg and flex the joint to about ten degrees. The subsequent course was eminently satisfactory and uneventful. When the patient left the hospital, about four months after the operation, she could flex her leg voluntarily to right angles and was walking without any support whatever (Figs 54 and 55).

**SHOULDER**—The technic described in my article in 1902 has not been changed. We have not yet had an opportunity to perform a typical arthroplasty on the shoulder. In one case a partial arthroplasty was done with a fairly good result. In the operation as worked out on the cadaver, the skin and deltoid are split and its fascia is separated along its anterior

margin for a distance of 4 inches, and elevated so as to expose the coracoid process with the attached heads of the biceps and coracobrachialis is divided about  $\frac{3}{4}$  inch from the tip and displaced outward. A curved chisel is then used to separate the bony union between the glenoid and the head of the humerus, and an additional excavation on the surface of the glenoid is made. An incision is then made at right angles to the original incision across the chest, over the middle of the pectoralis major muscle, a flap of fat, aponeurosis and pectoralis major muscle is then made,  $4\frac{1}{2}$  inches long and  $3\frac{1}{2}$  inches wide, with its pedicle left attached to the humerus. It is swung upward and interposed between the head of the humerus and glenoid, completely covering the bony surfaces. In lieu of this simple procedure, the following may be adopted, as described by Coville. He made a 4-inch incision, starting below the clavicle and passing external to the coracoid process, down along the arm, following the fibres of the deltoid muscle. This muscle is incised just outside of the deltopectoral groove, when the shoulder joint will be found to be exposed freely. Coville then extracted the head of the humerus and divided it from the remainder of the bone, at the level of the anatomic neck. The long strip of deltoid muscle was cut transversely, the superior portion being left adherent. A piece 4 inches wide was taken from the transverse section and interposed between the head of the bone and the glenoid cavity.

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passive motion was instituted and eventually the patient, a woman, was able to sew, although abduction was limited

**THE ELBOW-JOINT**—After the usual preparation of the field of operation, an Esmarch constrictor is applied high up on the arm. Formerly I made a vertical incision on the posterior surface of the arm, directly over the olecranon. I have since abandoned that procedure because of the fact that the contraction of the scar often interfered with free motion in the joint. I now make two lateral incisions, one on either side of the olecranon—although only one such incision may be necessary, depending on whether or not it is possible to work freely through an external incision without injuring the ulnar nerve.

If there is any danger of inflicting injury on this nerve, the second or internal lateral incision should be made. I always insist on finding the nerve, freeing it from adhesions, and retracting it out of the field of operation.

The length of this lateral incision will depend on how much of an area one wishes to expose. As a rule, an incision about 6 inches in length is sufficient, although there is no reason why it should not be made longer if necessary. The incisions are made about one-half inch to either side of the olecranon, and extend through the skin and superficial fascia. The edges of the wound are then retracted widely so as to give easy access to the joint.

The interposing flap in these cases is taken from the aponeurosis of the supinator longus and from the fascia and fat on the inner side of the joint. The bases of these flaps are directed upward. The flaps are made sufficiently wide so as to cover the freshened surfaces of bone, and long enough so as to reach across from one side of the joint to the other.

The ankylosis in the case of the elbow usually exists between the olecranon process of the ulna and the humerus. This is carefully divided by means of a curved chisel, twisted laterally, until free mobility of the joint is secured. In our earlier work I thought it advisable to separate the olecranon with its muscle attachment and retract it upward so as to ex-

pose the interior of the joint I no longer find this to be necessary, except in unusual cases

Sometimes there is a bony ankylosis between the head of the radius and the lesser sigmoid cavity When this exists it also is chiselled free, all exostoses are cut away and absolute freedom of motion is secured If necessary, the olecranon fossa may be deepened, so that the extension of the arm may be complete Ample bone should be removed from the humerus and radius to permit of free flexion and extension *without force*, and the anterior capsule of the joint fully and completely divided

Having secured the desired mobility of the joint and having freshened all bony surfaces, the next step in the operation is to place and secure the interposing flaps These flaps are drawn into the joint and secured on all sides with fine chromicized catgut sutures The ulnar nerve which was exposed at the commencement of the operation, so as to protect it from injury, is now replaced in its groove and surrounded by fat The remainder of the operation consists of the steps already described, such as closing the wound and applying the powder and dressings

The elbow is immobilized at a right angle, and a posterior and lateral three-fifths plaster-of-Paris cast applied At the end of from five to seven days the cast is taken off twice a day and passive motion is instituted At the end of ten days the cast can be removed permanently and the arm carried in a sling The patient is encouraged to make active and passive motion, and, if necessary, is ordered to carry sand-bags or other weights for the purpose of securing as much extension of the arm as is possible Massage may now be of service in increasing the function of the joint, or gas may be given to force the extension and flexion as early as the third week Care must be taken not to fracture the olecranon It should never be severely painful or prolonged

The following cases are illustrative of arthroplasties done on the elbow joint:

## ANKYLOSIS OF ELBOW FOLLOWING INTRANASAL OPERATION

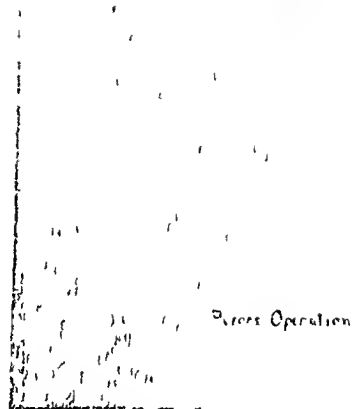
CASE XI—Miss L H S, aged 29, was admitted to Mercy Hospital November 27, 1908 Family history was negative She had had bilious attacks, occasional attacks of indigestion and chills and fever during childhood In the fall of 1905 she had a nervous breakdown and was sent west to recuperate This attack she says had been coming on gradually, but was precipitated rather suddenly by an intranasal operation consisting, she thinks, of the removal of bone

*Present Trouble*—In March, 1906, she suddenly developed high temperature and had a sharp pain in left arm which kept her from sleeping A physician was sent for at once and diagnosed the case as one of articular rheumatism She was sent to the hospital two days later and an incision was made on the back of the arm just below the elbow on the tenth day Serum only was evacuated In about ten days the bone was scraped and the wound was kept open with drainage for six weeks, during which time it continued to discharge serum That condition continued from March until June, during which time she was in bed, and when she recovered, her arm was absolutely rigid and slightly bent After about a year, an attempt was made to flex the arm under anæsthesia, and after that she could use the fingers and wrist, but the elbow remained stiff

*Examination*—There existed a bony ankylosis of the ulna and humerus and of the radius and humerus (Figs 56 and 57)

*Treatment*—First operation was done in November, 1908 A typical arthroplasty of the elbow was done, dividing the olecranon from the shaft A long fascial flap was taken from both of the triceps muscles and inserted between the ends of the bone Then the olecranon was wired back in place with phosphor-bronze wire Passive motion was instituted at the end of two weeks It stretched the wire and permitted separation of the approximated surfaces of the olecranon This allowed the acute angulation of the olecranon to the ulna, and made a cup-shaped olecranon fossa The tip of the olecranon and coronoid limited motion (Figs 58 and 59) There was no return of the bony ankylosis At the second operation, May, 1909, the tip of the olecranon was removed and also the tip of the coronoid process, so as to make the normal curve and adjustment to the trochlea

FIG 57



FIGS 56 and 57  
tion, with arm flexed at  
was also an ankylosis of

of the left elbow joint of 2½ years duration. The normal conformation of the joint is lost. There is a fusion of the humerus and ulna.

FIG 58

FIG 59



FIGS 58 and 59 — Case XI. Skiagrams made after the first operation on the olecranon was wired to the shaft of the ulna. The first skiagram was made about three weeks after the operation and shows the fragments approximated. The second skiagram was made after passive motion had been instituted and shows the separation of the fragments.



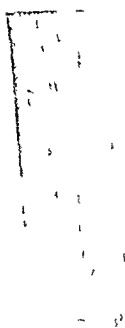


FIG 62

FIG 61

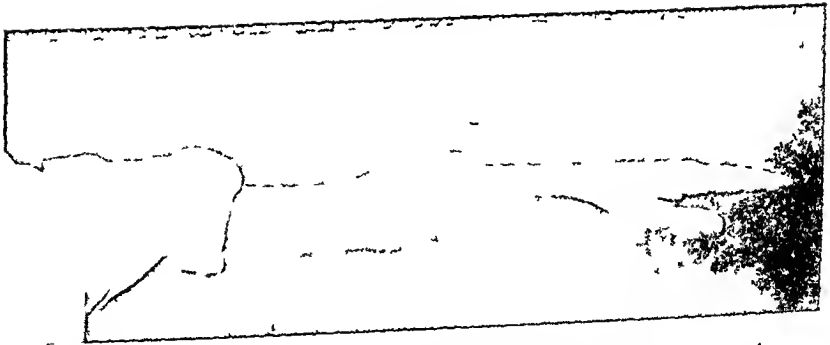


FIGS 60 61 and 62 —Case XI Skiagrams made after the second operation showing that the olecranon has become firmly united with the ulna and that normal motion has been restored to the joint

FIG 63

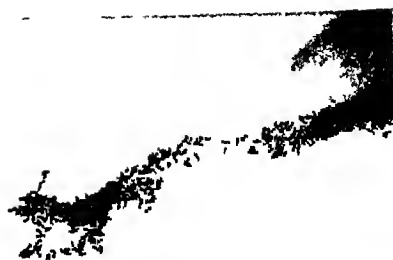


FIG 64



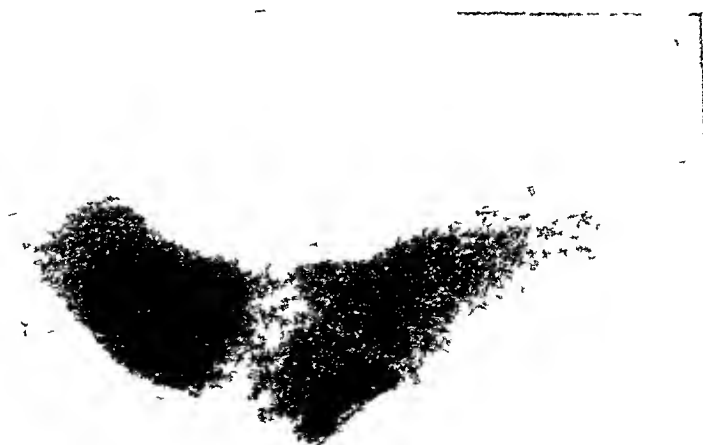
FIGS 63 and 64 —Case XI Photographs made eighteen months after the operation showing that the patient has full power of flexion and extension of the arm.

FIG 66



FIGS 65 and 66 --Case XII. Bony ankylosis of left elbow involving ulna and humerus and radius and humerus with pronation of the forearm and flexion at an obtuse angle

FIG 67



11 Skiagram made about a month after the operation. The joint cavity has been restored together with motion in the joint

Primary union occurred Since that time she has been able to flex and extend her arm fully and painlessly She does not know, except from a very slight limitation of pronation and supination, that she has ever had any trouble in the elbow (Figs 60-64)

*Result*—It is a perfect functional result. It is now four years since the operation, and the only evidence of the disturbance in the elbow is that she cannot fully extend the arm voluntarily There is lacking about five degrees of full extension, but she says that improvement is still taking place Motion in the elbow is otherwise full and free

#### ANKYLOSIS OF ELBOW FOLLOWING TRAUMA

CASE XII—F M, male, aged 58, entered hospital November 12, 1911, because of inability to use his left elbow He had a Neisserian infection 40 years ago. Was well in one week Denies chancres No history of secondaries

*Present Trouble*—On December 28, 1908, he fell from a load of hay, striking on his left side and point of left elbow Three ribs were broken and the skin was broken on point of left elbow Also thinks tip of olecranon was broken off He was given immediate attention by a physician

Four days after his accident his left elbow and forearm began to pain and became swollen This swelling and pain increased so that in from about five to ten days his elbow and forearm were swollen to three or four times their natural size and were of a bluish color The pain at this time was so severe that he became delirious, and he remained in bed with high fever and delirium until February 1, 1909 On that date he was anesthetized and the elbow was opened up and a tube drain inserted After this the forearm was incised at several places and pus evacuated Thinks drain remained in about three weeks

He remained in bed until sometime in May, 1909, when the swelling of arm had subsided and he felt well, but his left elbow and wrist were stiff In June, 1909, he was anesthetized again and the elbow was flexed forcibly After this he was given passive motion but every second day This was extremely painful and finally was abandoned The elbow again became stiff and it has remained so to the present time (Fig 68)

For the past two years his general health has been good He has had no pain or swelling in the left elbow or wrist

*Examination* —The elbow and wrist joints are ankylosed and fixed. The arm is flexed at an obtuse angle. There is a considerable degree of atrophy of all the muscles of the arm and forearm, especially of his biceps. The skiagram shows firm bony union between the humerus and ulna and humerus and head of radius (Figs 65 and 66).

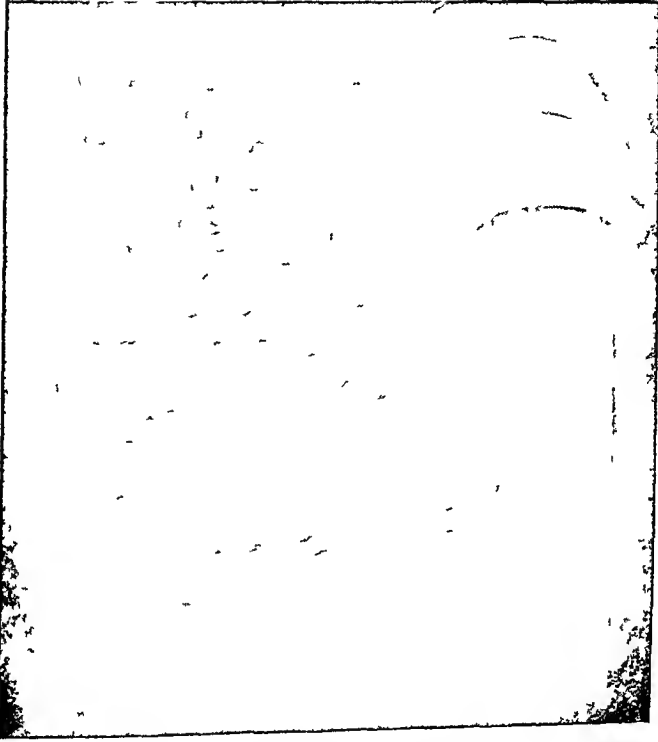
*Operation* (November 18, 1911) —Longitudinal incision over internal condyle, ulnar nerve exposed and dissected out of its groove. The nerve responded to faradic stimulation both above and below elbow joint. Similar incision over external condyle through skin and subcutaneous tissue. Interposing flap dissected from fascia of supinator longus muscle. Division of tissues between external condyle and olecranon process. Supinator longus split and head of radius and coronoid process exposed. The bony ankylosis of olecranon to internal condyle and head of radius to external condyle was chiselled loose. Part of the olecranon surface of the ulna, head of radius, coronoid process and part of the external and internal condyles of humerus were chiselled off and surfaces rounded off to resemble the normal conformation of the joint.

A flap of fat and fascia was dissected off muscles on inner side of elbow and drawn under ulnar nerve into the joint and through to its outer side and sutured in position so as to cover all bony surfaces of joint and prevent recurrence of the ankylosis.

The flap of fat and fascia from supinator longus was drawn into the joint from the outside and sutured into position, thus making a double interposing flap between the two joint surfaces. A fascial flap was dissected free from the inner side of the triceps tendon and pulled through and sutured to its outer side to prevent fixation of this tendon. The ulnar nerve was not reintroduced into its groove, fearing it would be injured by the formation of cicatricial tissue. It was left outside of the internal condyle and skin was closed over it. Both incisions were closed with horse hair, without drain. The usual dressing was applied.

The subsequent course of the case was uneventful. The wounds healed by primary union. The stitches were removed on the fifteenth day. Passive motion was instituted at once and then the patient was encouraged to use his arm. He rapidly regained motion in the joint, and when he left the hospital after eight weeks he had a great range of motion. He could flex his arm

FIG 68



Case XII Position of arm before operation There was also an  
ankylosis of the wrist-joint

FIG 69

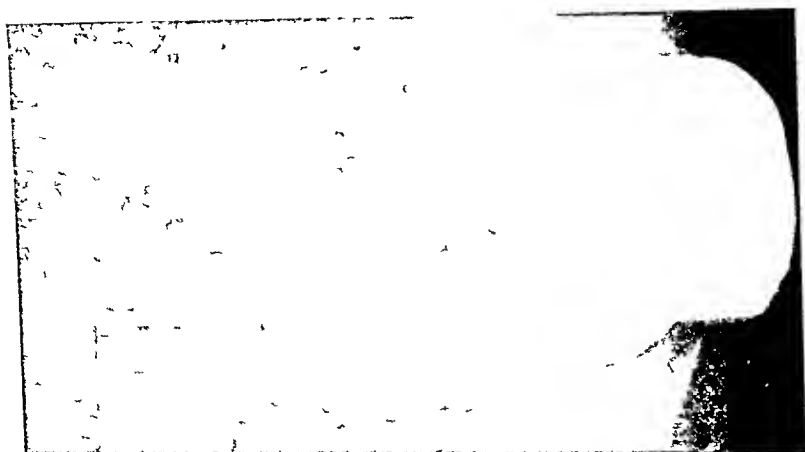
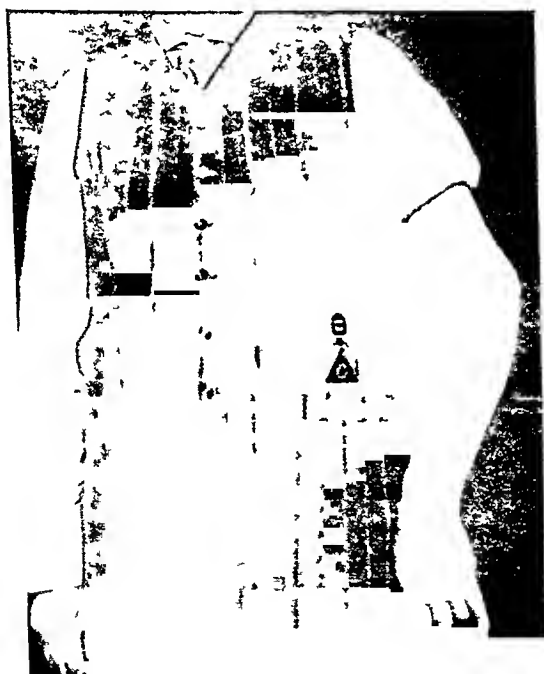


FIG 70



FIGS. 69 and 70 —Case XII. Photographs taken about six weeks after the operation showing the degree of flexion and extension the patient then had. A year after the operation he had practically normal range of motion.

Case XIII. Bone growth at the right elbow. The joint was completely destroyed by the excessive formation of new bone. The radius had been fractured about two inches below the joint, but the union of the fragments with overlapping had taken place. The arm was flexed to nearly right angles.

FIG 72



Case XIII. Position of arm before operation



FIG 75.



Case XIII Photograph made about a month after operation showing the degree of flexion patient then had

FIG 73

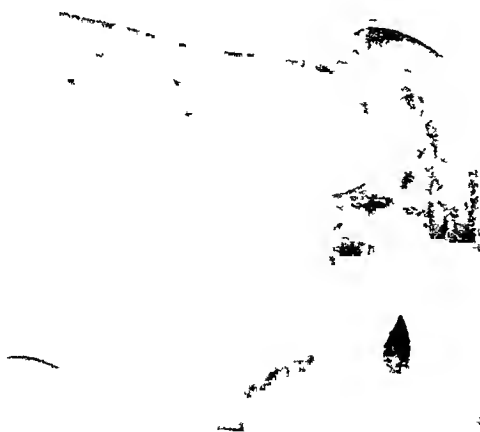


FIG 74

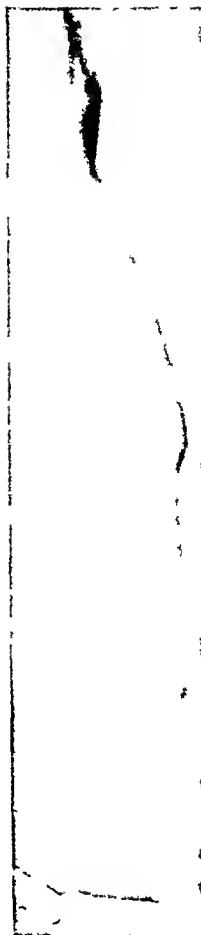


Figs 73 and 74—Case XIII. Skilograms made about a month after the operation. The normal anatomy of the joint has been restored in spite of the large amount of bone which had to be removed at the operation. The head of the radius was removed as can be seen in Fig 74

FIG 76



FIG 77



Figs 76 and 77—Case XIII. Photographs made ten weeks after the operation showing that the patient had a full range of flexion and extension

to less than a right angle and extend it to an angle of about 165 degrees. When last heard from, about a year after the operation, he had a range of motion of nearly 120 degrees (Figs 67, 69 and 70).

#### ANKYLOSIS OF ELBOW FOLLOWING TRAUMA.

CASE XIII —Miss S, aged 35 years, came to the hospital on account of bony ankylosis of right elbow joint. End of June, 1909, she slipped and fell, striking the floor on her right elbow. Her elbow pained her considerably and she supported her forearm with the other hand. The next day the elbow was swollen and painful and she consulted a doctor. A skiagram was taken and one of the bones entering into the formation of the elbow-joint (she does not know which one) was found to have been broken. Arm was put up in a sling flexed to a right angle and midway between pronation and supination. It was removed from the sling daily and the doctor flexed and extended it. This caused the patient great pain.

After seven weeks of this treatment patient was unable to use forearm. She does not remember if she could use her fingers. She was operated on August 17, 1909, and an arthroplasty attempted. Patient does not know what was done, no cast was put on, when stitches were removed a week later there was fair movement in the joint but it was painful. A few days later pus discharged, and an additional opening had to be made on the outer side of the elbow. Shortly afterward a small rubber drainage tube was inserted and the joint was irrigated daily with  $H_2O_2$ . The pus discharge lasted about six weeks, but it took eight or nine months for the wounds to be completely healed. At the end of this time there was no motion whatever in the joint. During the stage of active infection her arm and forearm were powerless, the muscles had wasted and it was proposed that an amputation be done. Patient declined the operation.

Three months after leaving hospital she fell down stairs and injured the same forearm. Her doctor told her that one of the bones was fractured about its middle. Patient was anesthetized and an attempt made to move the joint as well as to set the fracture. A plaster-of-Paris cast was put on and left on for two months, but there was no movement in elbow. The elbow now is ankylosed, flexed to a right angle, and the forearm is midway between pronation and supination (Figs 71 and 75).

*Examination* —There was entire lack of motion The elbow was large and the skiagram showed that this was caused by the production in excess of callus, the result of the previous fractures There was firm bony union between ulna and humerus and radius and humerus The radius had been fractured about two inches below the joint and union had taken place with a considerable overlapping of the fragments. There was no evidence of fracture of the shaft of the ulna The olecranon process was very thick, as was also the lower end of the humerus due to exostoses (Figs 71 and 72)

*Operation* (September 30, 1912) —Two longitudinal incisions were made on the posterior aspect of the arm, one to the outer and the other to the inner side of the olecranon The ulnar nerve was isolated, freed from its bed and carefully retracted to one side The joint was then exposed The normal anatomy of the joint was completely destroyed The radius was exposed and the head and neck of the bone down to the orbicular ligament were removed with bone-cutting forceps The ulna was chiselled free from the humerus at the line of bony union The coronoid process and tip of the olecranon were chiselled off and about one-fourth of an inch of both condyles of the humerus was removed with a curved chisel The olecranon fossa was deepened It was then possible to fully extend and flex the forearm, all excessive newly formed bone having been removed *with periosteum* and enough space provided between the humerus and ulna for the two interposing flaps which were dissected free from the outer and inner aspects of the forearm in the usual manner These flaps were drawn into the joint so as to cover the whole articulating surfaces of the humerus and sutured in place with chromicized catgut These flaps overlapped in the middle The inner flap was placed under the ulnar nerve The incisions were closed with plain catgut in the deeper layers and horse hair approximated the skin edges Bismuth subiodide and collodion gauze sealed the wound A 5 per cent moist phenol gauze, covered by rubber tissue and a sterile roller bandage, completed the dressing A plaster-of-Paris cast was applied with the arm flexed at an angle of 45 degrees This cast was cut as soon as the plaster had set, in accordance with our usual custom

The first dressing was made after two weeks Primary wound healing Stitches removed Passive motion instituted

The subsequent progress of the case was a very satisfactory one. When the patient left the hospital, after ten weeks, she was able to extend the arm voluntarily to within five degrees of full extension and to flex to an acute angle with the humerus angle. She has reported since that motion was improving steadily and that she has not had any pain in the joint (Figs 73, 74, 76 and 77)

**WRIST**—In the case of wrist-joint ankylosis, which exists between the radius and the semilunar and scaphoid bones of the carpus, a straight incision is made over the posterior surface of the head of the radius, extending from an inch to an inch and a half above and below. The length of the incision will depend on the ease with which the seat of the ankylosis may be brought into view. This primary incision extends through the skin and superficial fascia, as is usual in these arthroplasty operations. The flap is taken from the deep fascia and the joint capsule. It is U-shaped, with the base directed upward, and after the ankylosis has been freed by means of the chisel, and the natural conformation of the parts has been restored, this flap is pushed down between the carpal bones and the head of the radius, after one has satisfied himself that the motion in the joint has been restored.

As a rule, it is not necessary to expose the anterior surface of the joint for the purpose of suturing the flap in place, but if this cannot be accomplished satisfactorily, the anterior incision should be made. When only the posterior incision is made, the flap is tucked down to the depth of the wound and is sutured with phosphor-bronze wire to the posterior surface of the anterior capsule of the joint, and laterally to the periosteum of the bone. The capsule of the joint is then closed in the usual manner and likewise the external incision. Sufficient of the radius must be removed to admit of perfect flexion and extension.

The bismuth subiodide powder and a collodion dressing are then applied, and over this a moist 5 per cent phenol gauze dressing is placed, and outside of this the dry dressing.

The application of a three-fifths dorsal plaster cast, extending to the tip of the fingers, completes the operation

The cast is removed temporarily in from five to seven days, and passive motion of the joint is instituted. After the lapse of ten or twelve days the cast may be left off, so that the patient can follow the usual instructions with reference to the use of this joint

The following case is illustrative of this operation

#### ANKYLOSIS OF WRIST.

CASE XIV—Mrs R C B, aged 48, was admitted September 29, 1911. Family history was negative. She had had mumps eight years ago and pneumonia when a child.

In July, 1910, she felt indisposed during the day, and at night had a slight chill, accompanied by vomiting and fever. The next morning she felt stiff and sore and remained in bed. She had no definite pain. That evening her joints began to swell, the left elbow, wrist and phalanges, then right wrist and phalanges. They were red, tender, and painful. The next day the right ankle, then the left, both knees and right shoulder gave trouble. The left shoulder and elbow were not affected. She was in bed for two months with high temperature, and was unable to move. Resolution followed in all the joints except the right shoulder, wrist and fingers of the right hand. The right forearm and shoulder were put in a cast for a month. The fingers and wrist were much swollen and œdematous for seven months. The shoulder became stiff. The adhesions were broken up under anæsthesia, and there has been no further trouble in that joint. The fingers and wrist became stiff after seven months and have remained so (Fig 79).

*Examination*—There was ankylosis between the radius and scaphoid bone. Blocking of the latter prevents flexion. The semilunar appeared to be free (Fig 78).

*Treatment*—An incision was made over the end of the radius on the back of the arm and a flap of superficial fascia and fat was elevated. The union between the radius and scaphoid was exposed, separated with a chisel and one-third of an inch of bone removed. The fascial flap was interposed between the radius and the scaphoid in such a way as to produce a complete separation.

FIG 78

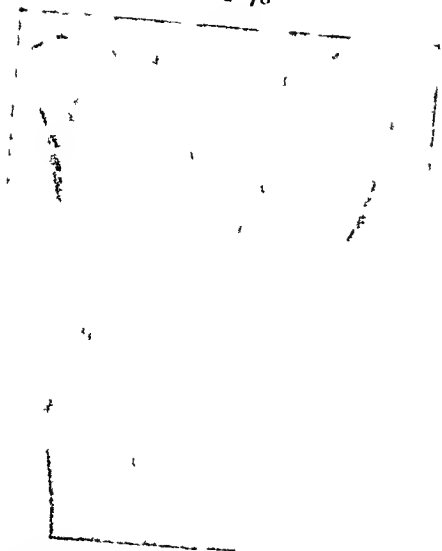


FIG 79



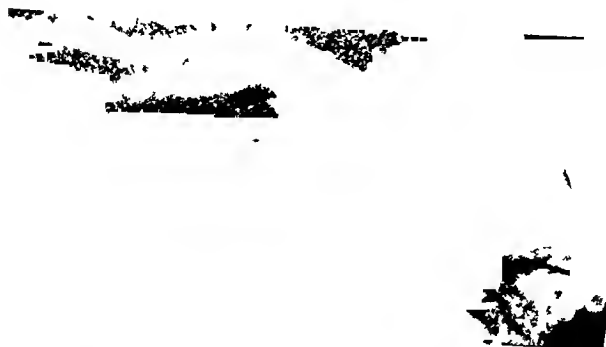
Case XIV Ankylosis of wrist joint involving the radius and scapoid

Case XIV Photograph made before operation showing position of the wrist and fingers with inability to flex the fingers on the palm

FIG 80



FIG 81



Figs 80 and 81 —Case XIV Photographs made several months after the operation showing the degree of flexion and extension the patient had at that time



It was fixed by suturing the base of the flap across the line to the upper surface of the fibrous capsular attachment of the scaphoid. Primary union resulted. There was considerable pain when motion was attempted. After the stitches were removed motion gradually increased and there was no return of the ankylosis, although motion was limited (Figs 80 and 81).

I wish again to emphasize at this juncture the value of the trochanteric fascia as an interposing flap, in the performance of an arthroplasty on any joint. I have shown in my work, and it has also been shown by others, that the transplantation of free flaps of fascia is not only possible, but productive of the very best results. I favor the trochanteric fascia, or what I have referred to several times as the fascia lata, with the trochanteric bursa. It serves a most useful purpose when it is impossible to secure efficient tissue elsewhere in the vicinity of the joint, to supply as an interposing flap, and if this is borne in mind the arthroplasty cannot fail to be entirely satisfactory. Ankylosis will not recur if sufficient tissue is interposed between the ends of the bones, and if this cannot be obtained from the adjoining tissues, it may be taken from elsewhere, and especially from the fascia lata.

These autogenous flaps are applicable not only in the case of very thin patients who possess little subcutaneous fat, but also in that large class of cases where previous disease, infection and drainage have left practically no free tissue in the vicinity of the joint to be operated.

This is especially true of ankylosis following tuberculosis of the hip, knee and ankle, complicated with mixed infections.

TEMPOROMAXILLARY JOINT — This is often a very difficult joint to free, as a flap is not easy to secure and the ankylosis may be both articular and exarticular combined, or the degree of bony fixation may extend forward from the joint and include the zygoma and coronoid process. The incision should be just above the zygoma and down to the fascia but not include it.

By making an anteroposterior, bow-shaped bone division, with the convexity downward on one side, at the point where



the neck begins to spread out into the broad angle, and a transverse bow-shaped division of the other side, with the convexity directed downward, the articulations are prevented from becoming displaced laterally subsequently, and no risk is run in dividing the bone or of injuring (a) the facial nerve or (b) the temporal bone. The incision should be made from the posterior margin of the ascending ramus, displacing the facial nerve and parotid gland. The incision may be a straight one, two inches in length, extending from the lower margin of the zygoma up into the hair. It is made just in front of the ear. In cases of ankylosis existing from infancy or early childhood, with aplasia of the mandible, this incision is particularly applicable.

In 1898 I operated in a case of this kind in Mercy Hospital, and found the technic exceedingly trying. The patient was a young man about 24 years of age, in whose case the ankylosis had resulted from a fall on the chin when he was three years old. There was considerable aplasia of the bone.

Since then I have had two cases of ankylosis of the jaw. In one case the ankylosis on the left side was purely fibrous (Case 15) and due to muscular contraction. On the right side, however, the ankylosis was bony, extending clear across the temporomandibular articulation and involving the coronoid process of the inferior maxilla and zygoma. In this case the vertical incision was made just in front of the ear, beginning in the hair-line and extending down to the lower border of the zygoma. This gave a very good exposure of the joint.

#### BONY ANKYLOSIS OF RIGHT TEMPOROMAXILLARY JOINT AND FIBROUS FIXATION OF LEFT

CASE XV.—F. D., aged 15, came to the hospital on account of fixation and deformity of lower jaw.

When six months old a swelling developed rather suddenly in front of the left tragus. A few days afterward pus discharged from the left external meatus for four or five days and the swelling in front of the ear disappeared. There was no swelling over the mastoid then or since, and he has had no further trouble with that ear.

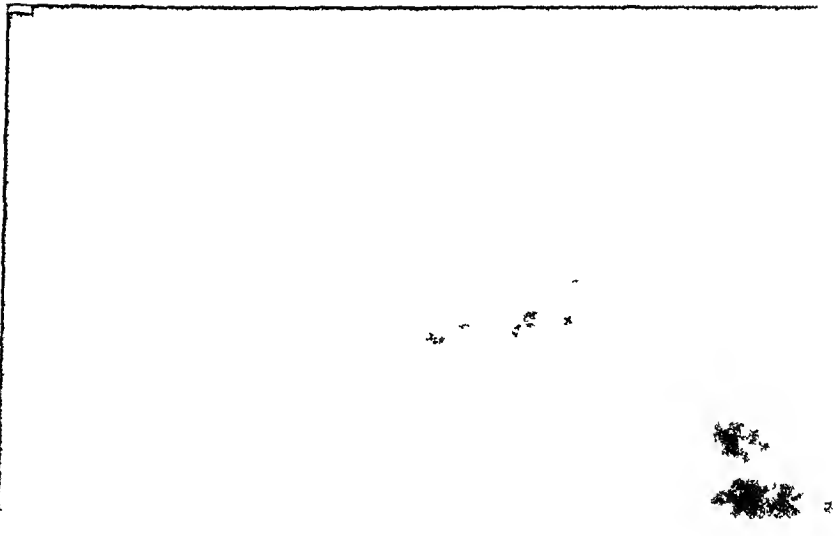
From what his parents told him, he had no throat or skin

FIG 82



Case XV Skiagram showing the left temporomandibular joint in which the fibrous band on

FIG 83



Case XV Skiagram of the right temporomandibular joint showing bony ankylosis ex condylar ankylosis

FIG 84



FIG 85



FIGS 84 and 85—Case XV Photographs taken before the operation showing the position of the jaw and the extent to which the patient could open his mouth. The jaw was absolutely fixed and the patient could only retract his lips

FIG 86



Case XV Photographs made about a month after the operation when the patient was able to open his mouth easily for an inch. He has since then succeeded in opening it so far that he can place an apple between the teeth

passed through the free edge of the flap, and through the fibrous capsule on the inner side of the joint. These sutures were tied in the inner incision.

A similar, though smaller, flap of tissue was dissected from the vastus internus and placed between the patella and the femur on the inner side. This flap was sutured to the capsule with catgut. After removing the Esmarch constrictor, all bleeding points were secured, and the wound closed with catgut sutures.

This operation gave splendid results, but it was rather extensive and complicated, and I have modified it somewhat in a number of points (Figs. 45, 46, 47 and 48).

CASE IX—Mrs C, aged 32, came to the hospital on account of inability to bend her right knee-joint.

*Present Trouble.*—On the evening of March 26, 1911, the patient attended a dance 8 miles out in the country. The day had been an unusually warm one for the season, and the patient exchanged her heavy under garments for lighter ones. The ride to the dance was warm, but after the dance, about midnight, the weather had turned quite cold and she was chilled through and through on the way home. The next morning when she awoke she felt a sore spot on the outer side of the right knee, and when she got up she found the joint a little stiff and sore. She thought the proper treatment was to exercise it and proceeded to give it a "work out." Everything went all right. She sat down to dinner about 1 30. When she tried to leave the table a half hour later the pain in the joint almost caused her to faint. She went to bed and applied a hot water bottle. She felt better in the evening and about 8 o'clock she came down to tea. Again, when she left the table the pain in the joint was intense, and she immediately returned to bed and remained there a week. The doctor gave her liniment, blisters and woollen bandages. The knee became red and swollen but she did not know whether the disease or treatment caused it. She had no chill at any time, unless it was on her way home from the dance, but thinks she had a rise of temperature.

At the end of a week she got up and went out calling. The knee was sore and stiff but did not pain. The following morning she could not put any weight on it and went back to bed; this time to remain six weeks, with the same treatment as before. At the end of this time the knee was stiff and swollen but the pain

his mouth far enough to put in two fingers Stitches removed sixth day Primary union, could open mouth freely By means of a wooden wedge, which he shoved between his teeth, the boy quickly increased the range of motion, and when he left the hospital at the end of four weeks he could open his mouth voluntarily one inch (Fig 86)

The interesting feature in this case was the fact that the clinical history pointed solely to the left side as the one involved in the original infection which led to the ankylosis The right side apparently was not involved at any time If the mouth could have been opened after the muscles and fibrous tissue on the left side were divided, we would not have operated on the right side at all, but when this was not possible we were convinced that there was something radically wrong on the right side, which proved to be the case There was a complete bony ankylosis extending all the way across from condyle to coronoid process The ankylosis was freed in the normal line of the joint by means of a small curved chisel and then we interposed a flap taken from the fascia of the temporal muscle, base downward The tip of the flap was passed into and through the joint and sutured to the temporal fascia The result was an excellent one, as may be seen by consulting the history of this case (see illustrations) This operation will not suffice for periarticular maxillary cicatricial fixation That subject will be discussed in another article

#### ANKYLOSIS OF TOE

CASE XVI—Miss M C, aged 24, was admitted to Mercy Hospital February, 1912, because of trouble with her toe Had measles, whooping-cough and mumps when a child, smallpox ten years ago, typhoid six years ago, and a second attack four years ago Appendectomy three and one-half years ago Six years ago small toe on left foot was removed because of an infection Leucorrhœa for past four years When five years old a nodular growth, which she thinks was bony, was removed from the under surface of the first metatarsal bone of left foot For a long time after the operation the joints of that toe were painful and swollen, and the toe has been thick and nodular in places ever since Three years ago pus was evacuated from the dorsum of this toe. This procedure was repeated two years ago The toe has never been injured

*Examination*—Great toe of left foot was found enlarged to twice its normal size. Phalangeal and metatarso-phalangeal joints ankylosed. Slight tenderness over all joints.

*Treatment*—Incision made on dorsum of great toe and firm osseous union of metatarso-phalangeal joint found. Bone was cut through at site of ankylosis with chisel and a section removed, so as to permit of the interposition of a flap of soft tissue which would prevent the recurrence of the ankylosis. Flap of fat and fascia was dissected loose from the inner side of the foot, base upward, and placed between the bone fragments, being held in place by a few phospho-bronze wire sutures. The metatarsal bone of the fifth toe was also exposed by an incision over the dorsum of the toe, and a dense mass of fibrous tissue was removed. Catgut was used to close the deeper layers of the wound, and horse hair closed the skin incision. The wound was dusted with subiodide of bismuth and sealed with collodion gauze. A 5 per cent phenol gauze dressing was applied. Stitches were removed on the tenth day. Primary union. When the patient left the hospital on the eighteenth day, she had fairly good motion in the joint.

#### PROGNOSIS OF ARTHROPLASTY

1 Perfectly movable, normally functioning joints with sliding and rotary motion of the normal type, can be and have been reproduced.

2 A new synovialoid membrane is produced with fluid not synovial, but resembling synovial fluid, and lining cells identical with those lining the hygromata, and closely resembling the endothelial cells of normal synovial membrane.

3 These joints support full weight and traction.

4 They are painless once the process of repair is complete.

5 They are not subject to the hæmatogenous metastatic arthritides of normal joints.

6 A fibrocartilage-like structure develops on the end of the bone, and the latitude of motion increases with time up to the full anatomic limitations in the uncomplicated cases. The production of new joints is not difficult technically, nor

is it associated with great danger to life The many details in the interposition of the flaps are essential, and must be systematically carried out to achieve the best results Asepsis is essential though not absolutely necessary

The results we have obtained from this work have been most gratifying, not only to us but to the patients, and it is the patient who must be considered One patient, a case of aseptic ankylosis of the elbow, was not benefited primarily The woman was exceedingly nervous and under no circumstances would she permit of passive motion, nor would she attempt any active motion The ankylosis recurred and the elbow is as motionless now as it was before the arthroplasty was done Elbow arthroplasties have been usually successful, so that it may safely be said that the failure in this case was due to the patient's unwillingness to cooperate and not to the operation

Another patient, a case of ankylosis of the knee, in which we were called on to do an operation after she had been operated on for a suppurating joint and ankylosis resulted, did fairly well while at the hospital The patient was a very intractable neurotic young girl, and while we secured motion of about 45 degrees for her before she left the hospital, she did not carry out our instructions after she left the hospital The result was that she returned about a year later with a recurrence of the ankylosis The knee was flexed about 30 degrees, but the leg was plumb, whereas when she came to us the leg from the knee on down was abducted in addition to the great flexion at the knee No further effort to relieve the ankylosis was undertaken in this case

One patient who had a double ankylosis of the hips died, as mentioned above

In a few cases of arthroplasty on the knee-joint, the tip of the skin flap necrosed, so that passive motion could not be instituted as early as was usually done The restoration of motion in these cases was delayed, and it is possible that motion may not be as free or complete as in those cases in which flap necrosis did not occur This accident will not

occur again, since we no longer use the curvilinear incision. The accident is, however, a very rare occurrence.

We have devoted much time and attention to the prophylaxis of ankylosis. We believe that the great majority of cases of ankylosis, the result of a metastatic arthritis ("inflammatory rheumatism" which is initiated with a chill) are avoidable. We are absolutely convinced that the contortion deformities following metastatic arthritis are avoidable. The acute arthritides, and especially those that have an initial chill, are surgical lesions from the very first day. The initial chill is a warning that ankylosis probably will occur, and therefore the limb must be kept in a good position from the very beginning and the interarticular pressure produced by involuntary muscle contraction must be overcome. This is best accomplished by some type of Buck's extension. This not only prevents the deformity, but greatly alleviates the suffering of the patient, and usually, we believe, prevents the occurrence of the ankylosis. *The plaster cast in ACUTE INFECTIONS always favors ankylosis and should never be used.* In tuberculosis it favors repair and therefore lessens the likelihood of ankylosis. Extension of SUFFICIENT weight to overcome the muscular contraction is the ideal means of preventing deformity and avoiding ankylosis.

Our final conclusion with regard to arthroplasty is, that where the technic of the operation is carried out properly, in a primarily sterile field, the results far exceed our original expectations. They can be secured uniformly, not only by us but by others, and when they are not secured the failure must be charged to some defect in technic or in the subsequent management of the case.



# THE IDENTITY OF CAUSE OF ASEPTIC WOUND FEVER AND SO-CALLED POST-OPERATIVE HYPERTHYROIDISM AND THEIR PREVENTION.<sup>1</sup>

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THE temperature of warm blooded animals is rigidly maintained within a certain range. The source in the normal state of their body heat is oxidation of chemical compounds.

Physicists tell us that any form of force may be converted into heat, hence one would expect to find among other physical results production of heat as a result of both motor and emotional acts.

Both motor and emotional acts are produced by adequate stimuli. When an adequate stimulus reaches the brain, whether it be psychic or mechanic, there is a discharge of nervous energy, *i e*, there is oxidation. The discharge may be attended by visible action such as voluntary muscular action or invisible muscular and glandular action and brain action. One of the results of this release of force is the production of heat. This heat is clinically indicated by the thermometer. Quite apart from infection or disease what influences may produce increase in temperature? Anything that will drive the motor mechanism, such as emotional stimulation, physical injury, muscular or mental work, thyroid extract and iodine. Among examples are anger, play, athletic contests, fear, and other states of rapid consumption of energy. I have seen the temperature rise three degrees in 15 minutes in a rabbit frightened, and a degree in a child in a tantrum. Routinely one sees some rise in the temperature of a patient on the day of his admission to the hospital, and I have often

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\* Read before the Southern Surgical and Gynæcological Association,  
Dec. 17, 1912

observed a rise in the pulse and the temperature of anxious relatives, while a visit from an emotional friend to an emotional patient will routinely cause a rise in a patient's temperature (Fig 1) Now what relation has this to aseptic wound fever and to post-operative hyperthyroidism? Since performing operations under the principle and the technique of anoci-association we quite unexpectedly observed a changed post-operative temperature and pulse curve (Fig 2) Analyzing this we found that the same technique that controlled post-operative hyperthyroidism also controlled aseptic wound

FIG 1.

Pulse of	80	100	120	140	160
Patient with Exp Gaiter	Before operation				
	After operation				
Pulse of Sister of Patient	Before operation				
	After operation				

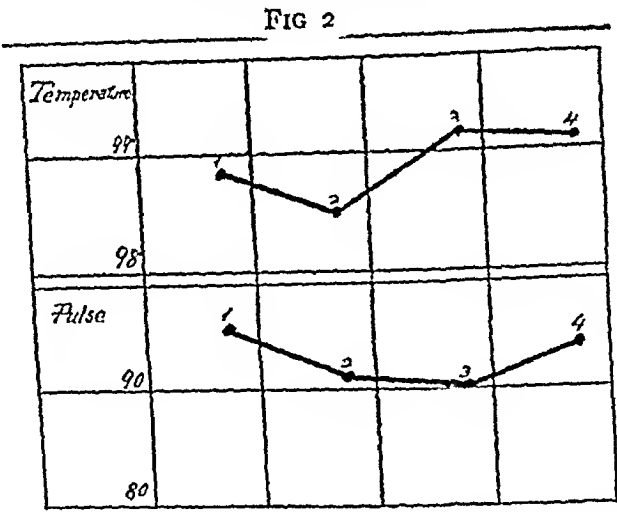
Operation performed under Anoci-association, i. e. the patient's brain received neither traumatic nor psychic stimuli from the time she was anesthetized in bed until returned again from the operating room. There was no increase in the pulse rate at the end of the operation. The sister of the patient knew of this serious operation. While waiting for the patient's return from the operating room her pulse rose to 124.

fever. Furthermore, if any parts of the anoci technique were omitted we then observed more post-operative phenomena.

The final convincing proof came when the post-operative wound stimuli were also excluded by blocking the wound with quinine and urea hydrochloride, and with the exclusion of the psychic and the traumatic stimuli in both the operative and the post-operative phases, we found that, barring infection, the post-operative phenomena of temperature and pulse were almost wholly eliminated. The conclusion then is that these phenomena are the result of the conversion of energy into heat as a part of the activation of the brain, hence all of the body, by the psychic and the traumatic stimuli.

Now these observations suggest that there exists some common principle which underlies post-operative hyperthyroidism and aseptic wound fever, and the fever produced by

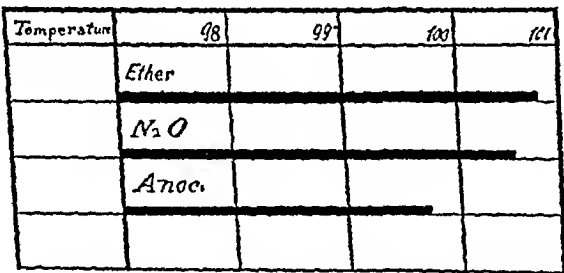
physical exercise and the primitive emotions, such as fear, anger, and sexual excitation This general principle is, I



Comparison of the pulse rate and temperature before and after operation of 100 miscellaneous cases operated on under the Anoci association method (1) record at 5 P M day before operation, (2) immediately before operation, (3) immediately after operation, (4) record at 5 P M day of operation. Note how slight the reaction is

believe, a fundamental one, viz, that the entire mechanism of animals is motor, that all the functions are motor, and that the energy intended to be utilized in a motor act may in part

FIG 3



Thyroidectomy Each heavy line represents the average 5 P M temperature of ten patients during the first four days after operation

be converted into heat As to Graves' disease, I have heretofore given reasons for regarding this disease as being due to such a disarrangement of the general motor mechanism whereby the threshold of the brain to both traumatic and psychic stimuli is lowered to varying degrees Thus may a given stimulus that would cause no appreciable change in the

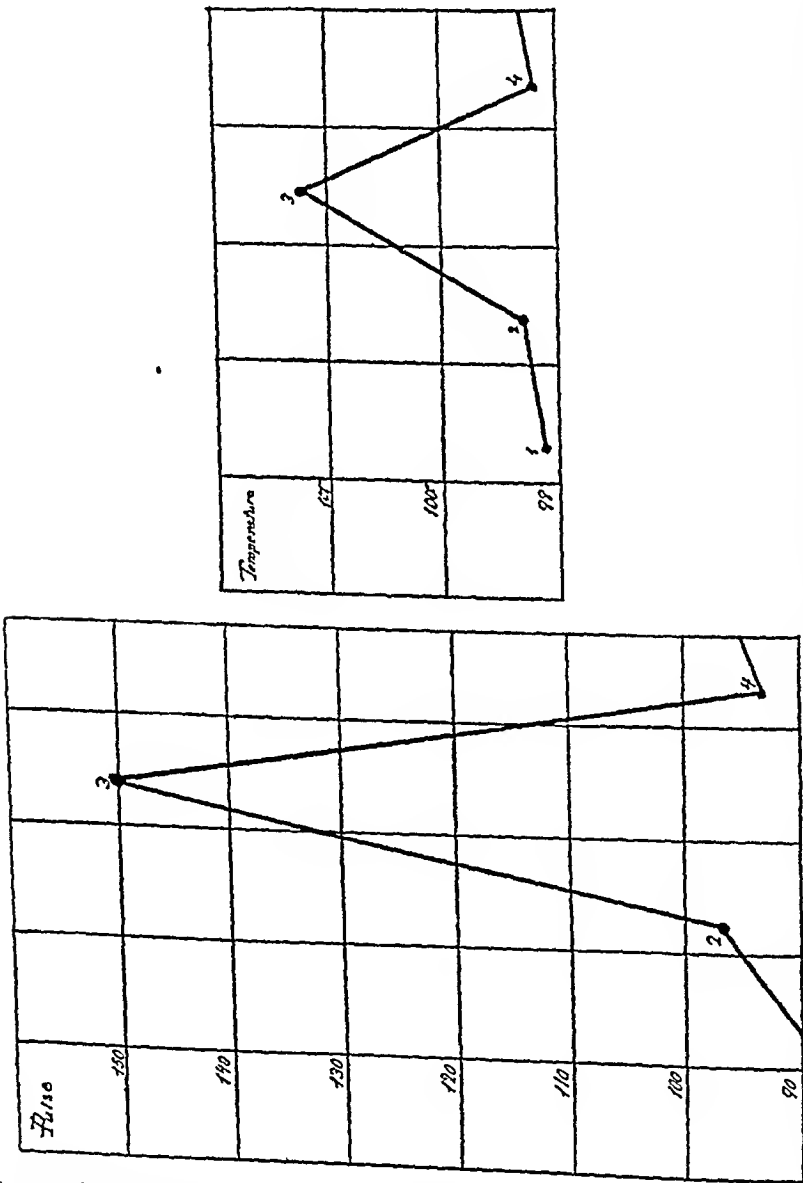
pulse or temperature of a normal individual, cause, in a case of advanced Graves' disease, with its low threshold, a manifold stimulation, and in consequence the brain and the body of the sensitized Graves' case would be driven as many times as hard, producing a correspondingly greater change in the temperature and in the pulse rate. This accounts for the influence of morphia on the pulse and temperature, because morphia raises the threshold to stimuli, *i e*, it makes it more difficult for a stimulus to reach and act on the brain cells. This hypothesis explains the temperature and pulse changes in the emotional state as well as in simple fractures, in the pulse and temperature changes produced by a stormy visitor as well as by the surgical operation. It also explains the negative side of these phenomena, *viz*, why a patient well under morphia, or in stupor, from disease, shows no such change; why the aged show so slight and the infant so great a change in pulse and temperature on excitation, why an operation performed under anoci shows no change. It explains why a case of Graves' disease under excitement quite independent of an operation shows precisely the same phenomena as a case of Graves' disease operated without anoci; and, finally, it explains the absence of these destructive phenomena following operations under anoci. This same principle applies as strongly even after the operation (Fig 3).

If at the time of operation a patient, whether a Graves' case or not, receives so powerful a psychic excitation that in imagery she tends to frequently recall that event, in so doing, each time the original harmful stimuli of the operation are recalled through associative memory, a driving of the motor mechanism is caused. Frequently does the patient recapitulate the anxiety, the suffering, in fact all of the noci-associations of the operation—until at last the power of recall fades from memory's view.

Now under anoci the threshold is ever kept high. There is no picture written upon the conscious or subconscious memory, for not even the operation itself has been recorded upon the brain.

Therefore, there can be no destructive recapitulations, there are no *noci-associations*, and time is not required to raise the threshold or to dim the memory. Thus is explained the speedier convalescence of the patient without post-opera-

FIG 4



Patient, a foreigner, was brought to the operating room from the accident ward. Pulse and temperature normal. When he found himself in the operating room he was greatly disturbed. It was impossible to make him understand that his leg was not to be amputated, but just a plaster cast applied. Under the psychological stimulus pulse rose to 150 and he soon developed a temperature of 101.3°

tive phenomena under the protection of anoci, and thus we see a general principle underlying both post-operative wound fever and post-operative hypothyroidism—hyperthyroidism being a pathologic, a magnified post-operative wound fever

# THE SURGICAL SIGNIFICANCE OF THE ACCESSORY PANCREAS.

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AN accessory pancreas is probably not an excessively rare abnormality. In spite of the fact that it would readily be overlooked in anatomical or post-mortem subjects, in which softening and putrefactive changes in the walls of the bowel would soon alter its appearance, at least 39 cases were on record in 1908<sup>1</sup>. It was first described by Klob in 1859, Zenker<sup>2</sup> two years later was able to give an account of seven cases. An excellent summary of the anatomical literature on the subject is given by Ruediger<sup>3</sup>.

The accessory pancreas is a small, rounded nodule, which may be as large as a filbert, situated somewhere in the wall of the alimentary canal, though there is one case on record in which it was found to lie close to the umbilicus in the abdominal wall. More commonly, it is situated (1) *in the wall of the stomach*, either near the pylorus, or the greater or lesser curvature, (2) *in the wall of the duodenum*, but detached from the true pancreas, (3) *in the first eight inches of the jejunum*, this is the commonest location, and both our cases fall into this class, (4) *in the lower jejunum or ileum*. In several instances it has been found near the ileocaecal valve.

In some cases it has been covered by a normal mucous membrane and serous coat, in others no villi have been present over it but it has bulged into the lumen of the bowel, as in the case figured

Histologically, it shows typical pancreatic structure and well-defined ducts

Up to the present, the surgical significance of the accessory pancreas has appeared to be very small. Ruediger was unable to collect any very definite evidence that it gave rise to symptoms. This view must now be subject to modification.

The accessory pancreas may give trouble in four ways.

1 *It may produce mechanical alterations in the walls of the alimentary canal.* Several cases are recorded in which it formed a complete ring around the duodenum with some narrowing, but in none do symptoms appear to have arisen. Similarly, it has exerted traction on the wall of the bowel and produced diverticula.

Cecchini<sup>4</sup> in 1886 published a case of gastroptosis apparently due to an accessory pancreas, but we have been unable to consult his pamphlet.

2 *The accessory pancreas is liable to acute pancreatitis.* Such a case occurred recently in the practice of one of us (A. R. S.), producing extreme inflammation of the wall of the surrounding jejunum and symptoms of a high acute intestinal obstruction. A careful search through the literature (including a large number of monographs, and the *Index Medicus* back as far as 1886) has failed to discover any similar record.

CASE I—F. R., a girl aged twelve, was sent into Cossham Hospital with a history of vomiting for four days. Dr Llewellyn, who sent her in, states that there had been no previous illness. The vomiting had become more and more frequent, though there was but little pain. She had had some diarrhoea. At first, a large quantity of "slime" was passed, on the second day a formed motion, and on the third half a pint of blood.

On examination in the hospital, she was a well-nourished girl, the facies was not drawn and anxious as in peritonitis. The pulse was about 80, but small, the temperature was 97.6°. The vomiting was now every ten minutes, consisting of bilious stuff, not fecal. The abdomen was nowhere distended, moved on

respiration, was not rigid, and did not show peristalsis. Nothing abnormal could be felt, there was a little pain and tenderness in the upper abdomen. Examination of the chest, rectum, and hernial orifices revealed nothing. The urine contained no albumin or sugar but was full of acetone and diacetic acid. While she was being examined she had a typical attack of tetany.

A provisional diagnosis was made of high intestinal obstruction or possibly mesenteric thrombosis, and immediate operation performed with the patient lying on her side to avoid calamities from the incessant vomiting. Open ether was given, and as a matter of fact very little vomiting occurred. An incision was made in the upper abdomen. The stomach was rather distended. The pancreas was examined through a hole between the stomach and colon, the tail could not be found. There was no fat necrosis (it was specially looked for). The first six inches of the jejunum, beyond the duodenojejunal flexure, was bright scarlet in color and the wall was more than half an inch thick, gradually fading off distally into normal jejunum. The mesenteric vessels were not blocked. About one and one-half inches from the duodenojejunal flexure, in the wall of the jejunum, was a white nodule projecting slightly under the serous coat. It was about half an inch in diameter and nearly escaped observation. It projected slightly into the lumen of the bowel. There was no peritonitis or lymph-clot.

As the inflammatory swelling involved the duodenum as well, it was judged impossible to resect the affected loop. The little tumor was cut out and the bowel sewn up longitudinally. Unfortunately the wall was so thick that this left but little lumen, and posterior gastrojejunostomy, of necessity with a loop to avoid the inflamed area, had to be performed. The nodule was excised on the supposition that it might be a sarcoma or myoma, in any case it was evidently the source of infection.

*After-history*—The vomiting was considerably relieved for two days, but the temperature rose. There was no sign of peritonitis, but she died about 50 hours after the operation. No autopsy was allowed.

The excised nodule proved to be an accessory pancreas in a state of acute necrosis, many of the cell nuclei being clouded or lost. There was no leucocytic infiltration. There were no



villi over the tumor, which projected slightly even in the swollen condition of the bowel wall. The ducts could be plainly seen, but they were not specially affected. The muscle fibres of the neighboring intestine had lost nearly all their nuclei and were infiltrated with leucocytes, in a condition of inflammatory necrosis, the neighboring villi were normal.

It would appear probable that in this case the exposed nodule of accessory pancreas became infected from the jejunum, acute pancreatitis supervened and excited acute inflammation of the muscular coat of the surrounding jejunum to such a degree as to produce considerable obstruction, incessant vomiting, slimy diarrhoea and melæna.

### 3 *Accessory pancreas may develop chronic interstitial pancreatitis* Mayo Robson<sup>5</sup> has reported such a case

The patient, a middle-aged man, was suffering from chronic obstructive jaundice without pain, and the Cammidge crystals indicated pancreatitis. On exploration, there was chronic cirrhosis of the head of the pancreas, and an accessory nodule in the wall of the duodenum also affected with cirrhosis. This was excised on the assumption that it might possibly be malignant. A cholecystenterostomy was performed and the patient recovered.

### 4 *Accessory pancreas may complicate the diagnosis of the cause of abdominal symptoms* This was so in the following case treated by one of us (T C) in 1908

CASE II—E D, male, aged fifty-five, was admitted to the Bristol Royal Infirmary complaining of vomiting and loss of weight. He had suffered from "urging" for a year, and periodical attacks of vomiting, up to about a pint at a time. He had lost two stone in three months. There was not much pain.

On examination, he was emaciated, and the sclerotics slightly yellow. The pulse was 62, small and soft. The abdomen was not distended, a small doubtful lump was felt in the epigastrium, the stomach, inflated with CO<sub>2</sub>, was not dilated. The gastric contents showed yeasts, a trace of lactic acid, and no free HCl.

On abdominal exploration, a small doubtful scar with surrounding infiltration was found on the pylorus. The stomach was not enlarged. The gall-bladder was very full of bile, with no

stones, although it could not be emptied by pressure. The pancreas was not indurated, but hard glands were felt near the bile-duct. In the wall of the jejunum, two inches from the duodeno-jejunal flexure, was a small, soft nodule about the size of a filbert (Fig 1). As nothing else very definite was discovered, this was excised and a no-loop gastrojejunostomy performed through the gap. The gall-bladder was drained.

The excised nodule proved on microscopical examination to be an accessory pancreas.

*After-history*—The patient recovered at the time and lost his icteric tinge, but he continued to lose weight, and after returning home he wasted exceedingly, suffered from pain and vomiting, and died in about seven months.

We do not suggest that the accessory pancreas had anything to do with this patient's symptoms. He was probably suffering from malignant disease of the pylorus, although it was regarded as inflammatory at the time of operation. But it is easy to believe that in doubtful exploratory laparotomies the discovery of a tumor in the bowel wall may be very misleading if the surgeon does not recollect the existence of such an abnormality as the accessory pancreas. If such should occur at the usual site for gastro-enterostomy, as in this case, it is conveniently situated for excision.

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# CYSTS OF THE SPLEEN.

A PATHOLOGICAL AND SURGICAL STUDY.

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COMPARED with the very extensive observations which have been made upon cysts of the ovary and kidney, their mode of origin, pathology, symptoms, and treatment, our knowledge of cysts of the spleen is very meagre. Cysts of the spleen have not been made the subject of exhaustive study because they are of relatively rare occurrence.

Contributions to the mode of origin and pathology have been published by Aschoff, Beneke, Bottcher, Coenen, Fink, Otto, Renggli, Ramdhor and Schmidt, the writer, and others, but it was not until 1904 when cysts of the spleen became the subject of surgical interest that a comprehensive clinical as well as pathological study was made of this lesion. This year marked a distinct advance in our knowledge of cysts of the spleen, when noteworthy contributions were made in Germany by Heinrichus, Monnier and Lasperes. Heinrichus and Monnier wrote from the surgical stand-point. Lasperes wrote upon splenectomy in general and devoted a portion of his paper to cysts of the spleen which had received this treatment. The subject was entirely ignored in English and American literature until 1905, when Bryan's monograph appeared in the *Journal of the American Medical Association*. This article was overlooked as well as a few isolated cases which appeared somewhat earlier by Powers of Denver, who analyzed 32 cases in 1906. During the past five years cases have been reported by Bircher, Coenen, Darling, Harnett, Huntington, Johnson, Kustner, Musser, myself, and others. Bircher's article, which appeared in Germany in 1908, is the most exhaustive. Since 1906 and up to 1912 no complete study has been undertaken by American or English authors.

affection at the time, and there was no noticeable deformity of his mandible then, and it was not until twelve months after his ear trouble began that they found that his lower jaw was fixed and immovable. Since then he has been unable to open his mouth.

His lower jaw is deformed. The normal angle of the jaw is absent and the symphysis menti is narrow, pointed, and drawn a little to the right of the median line. The molar teeth oppose each other on both sides, but his upper front teeth project beyond the lower teeth about one-half inch. The skin for a thumb's breadth to the left of the symphysis menti is contracted. This contraction extends into the tissue of the neck. The lower jaw is pressed firmly against the upper and he is unable to move jaw either way more than one-sixteenth of an inch (Figs 84 and 85).

There are no enlarged glands palpable in the neck, no discharge from either ear and no signs of old or recent mastoid trouble.

*Examination*—The physical findings were those mentioned above. The skiagrams showed an ankylosis, probably fibrous, of the left temporomandibular joint and bony ankylosis of right (Figs 82 and 83).

*Operation* (September 7, 1912)—Vertical incision on left side about one-half inch anterior to tragus, extending up into hair and down to long border of zygoma, avoiding temporal artery and facial nerve. Zygoma cut with bone-cutting forceps and turned forward out of field. Temporal muscle was detached from coronoid process. No bony ankylosis of joint but contraction of capsule which was completely divided. An incision was then made under angle of jaw and internal pterygoid and masseter muscles were freed. Mouth could not be opened after all this had been done. Zygomatic process reattached by wire suture. Skin edges approximated with horse hair. A similar vertical incision was then made over temporomandibular articulation on right side, zygoma cut and retracted forward. Bony union of temporomandibular joint out to tubercle on zygoma, also bony union between tip of coronoid process and base of skull. The neck of the mandible was cut through with chisel and burr, coronoid process removed. When this was done mouth could be opened easily. A flap from the temporal fascia was then interposed between the divided ends of the bone and fixed there by two sutures, wound closed with horse hair. Twenty-four hours after operation he could open

lymphatic cysts Such a classification is unsatisfactory The terms are misleading Grouping based upon the character of the wall of the cyst or its lining is equally unsatisfactory Some are of undoubted traumatic origin, others are possibly inflammatory, still others represent true neoplastic processes A distinction should be made between (1) hæmatomas, (2) cysts arising from the disintegration of splenic tissue (the result of occlusion of vessels by emboli, endarteritis or amyloid changes), and (3) genuine cysts of the spleen True cysts are exceedingly rare Pseudocysts will be considered as they have an important bearing upon the general subject Cysts may be situated in the peritoneal covering of the spleen (peritoneal cysts) beneath the capsule (subcapsular), or deep in the splenic tissue (intraparenchymatous) There may be a single cavity (unilocular cysts) or many intercommunicating pockets (multilocular cysts) They may be found in groups or singly, isolated or confluent When the cyst is solitary it is usually large and when multiple cysts are present they are usually small Classification according to contents does not afford an explanation of the mode of origin The writer offers the following which suggests this

- (1) Traumatic cysts (hæmatoma, large unilocular cysts, secondary serous cysts)
- (2) Infolation cysts (traumatic or inflammatory inclusions of peritoneum) Small multiple—superficial and deep
- (3) Dilatation cysts (ectasis of splenic sinuses)
- (4) Disintegration cysts (arising from arterial degeneration and occlusion or other arterial occlusion as from emboli, and resulting in infarction and necrosis of parenchyma)
- (5) Neoplastic types (hæmangioma and lymphangioma)
- (6) Degeneration cysts (arising from secondary changes in 5)

Further investigation is essential to a satisfactory classification of genuine cysts of the spleen We may include under this heading tentatively, infolation cysts and dilatation cysts

*Etiology*—The age was stated in 66 cases in this series In the majority the disease has affected persons in middle adult

life In but two cases were cysts found in infants under one year This would speak against their congenital origin, but would not exclude the possibility One case occurred between the ages of one and ten years, 8 cases between the ages of ten and twenty, 15 between the ages of thirty and forty, 14 cases between the ages of forty and fifty, 3 cases between fifty and sixty years In four cases cysts were found between the ages of sixty and seventy years Of those which were autopsy cases, all occurred in individuals over thirty

Females are predisposed to this condition. Of 65 cases in which the sex was stated, 38 occurred in this sex The majority occurred between the ages of twenty and forty during the child-bearing period Of the 14 cases which were studied at autopsy, 1 occurred in a female Monnier explains the predilection for the occurrence during the reproductive period of woman by the fact that the spleen becomes congested in pregnancy, during menstruation, and at the menopause, and subsequently relaxes In six cases in this series there seemed to be some relation between pregnancy and cyst formation The contents of the cysts which showed relation to pregnancy are stated in five cases Of these three were blood cysts and two lymphatic In Bircher's case "something" was discovered in the course of pregnancy alongside of the uterus, which subsequent operation showed to be a displaced cystic spleen Routier's case showed rapid increase in growth following pregnancy and normal labor, which occurred one year previously In Well's case an already existing tumor was found to be stimulated to increased growth by pregnancy Conen operated in the course of pregnancy and excised a spleen the seat of lymphangiectasis The splenic tumor was first observed following previous childbirth In the case observed by the writer the abdominal tumor was noticed three months after childbirth Downs reports the development of a cyst of the spleen, which he incised following confinement The walls were necrotic "Almost the entire spleen came away in sloughs" The most rational explanation of the development of cysts of the spleen following pregnancy is that

embolism which may occur in this state, leading to infarction and secondary hemorrhage, may eventuate in cyst formation. This explanation would seem to hold good in the cases of Bircher and Downs. Congestion of the spleen may explain the increase in size of an already existing tumor. The influence of pregnancy upon the formation of lymphatic cysts is not so apparent. Mechanical dilatation from pressure is a possible explanation.

Antecedent diseases of the spleen may exert an influence, especially malaria and syphilis. Hypertrophied spleens moreover are more likely to be recipients of injury, consequently hæmatomas could readily form. Perisplenic adhesions are prone to occur in hyperplastic spleens. There seems to be some relation between perisplenitis and the formation of cysts. Brunswig-le-Bihan states that in Arabs, hemorrhagic cysts, due to ruptures restricted by adhesions around the spleen, are not uncommon. Adhesions it must be remembered may be the result of cyst formation as well. Malaria was stated to have been present in ten cases. The spleen itself was found to be enlarged in those cases giving a malarial history (in four cases clinical evidence of enlargement only). They were all unilocular blood cysts except two. One specimen showed small, superficial multiple cysts with serous contents. A second had serosanguineous contents. It is conceivable that spontaneous rupture of a distended capsule from congestion of the pulp incident to typhoid fever, etc., might predispose to cyst formation. The relaxation and shrinking upon subsidence of hyperæmia leaves the capsule in a wrinkled state with countless furrows which might easily become sealed over by inflammation and result in infoliation cysts. The relation of peritoneal cysts to spontaneous rupture of the capsule of an overdistended spleen the seat of perisplenitis may be intimate. Subbotic observed small multiple surface cysts in malarial splenomegaly which possibly originated in this way. Syphilis was mentioned in two history records. In one the initial lesion occurred six years previously (Garcia), in the other case the history of the infection was lacking, but there was evidence of

the disease in the blood-vessels and viscera (Harnett) Aside from the greater danger to exposure to trauma to which an enlarged syphilitic spleen might be subjected, resulting in an hæmatoma, its liability to perisplenic adhesions with the subsequent development of infoliation cysts, cysts may occur within the parenchyma of the spleen the result of specific endarteritis Harnett considered that the spontaneous rupture of an intrasplenic blood-vessel was responsible for a case which he observed occurring in a man who gave postmortem evidence of syphilis, although neither the spleen nor its vessels showed evidence of this disease Bednar states that cysts of the spleen are frequently associated with pemphigus, and describes a small cyst occurring in a child of one week born with this disease In one case observed by Fereal a large abdominal tumor formed during an attack of mumps Operation subsequently revealed it to be a cyst of the spleen Aside from malaria and syphilis there does not seem to be any relation noted in histories which have been studied between diseases causing splenic enlargement and cysts of the spleen

In the etiology of large cysts of the spleen the one most generally acknowledged factor is trauma Injury was stated to have preceded the development of cysts of the spleen in 17 cases The interval between injury and development was stated in 13 cases In 5 cases the cyst developed within 1 year or less, in 7 cases within 10 years or less and in 1 case the cyst did not develop until 40 years had elapsed Such a long period of time would seem to exclude any relationship Of those cases which showed a relationship to trauma in which the contents of the cyst was stated, 12 were hemorrhagic 1 was lymphatic and 1 serous The injury has usually been a direct blow or a fall upon the abdomen Long-continued pressure of the left lower chest against a machine was mentioned in one case and a penetrating wound of the abdomen involving the spleen was mentioned in another case The history of trauma cannot be taken as proof of the origin of any particular kind of cyst although hemorrhagic cysts seem to develop most frequently The relationship of cysts arising



from inclusions of peritoneal endothelium in consequence of gross injury (traumatic infoliation cysts) is a theory which should be mentioned

Among these etiologic factors must be considered the influence of a twisted pedicle. This is suggested by its occurrence in two cases. In Bircher's case the cyst was not held responsible. The pedicle was twisted upon itself about 360 degrees. The cyst did not represent a large central area of necrosis which would follow the arrest of blood at the main source of supply. Under such an influence it is likely that the entire spleen and not a part of it would be involved. A peripherally located cavity in a spleen otherwise intact could hardly result from torsion of the main vessels. In Kustner's case the gastrosplenic ligament showed undoubted evidence of strangulation. He believes that this was the cause of the cyst formation. The cyst occupied four-fifths of the spleen. The parenchyma was reduced to a small, narrow, wedge-shaped area. He is of the opinion that hemorrhage occurred from stasis and that destruction of splenic tissue resulted in the cavity. One can hardly reconcile such a cyst as this writer describes with such a degenerative process.

*Pathogenesis*—Little has been added in recent years in explanation of the more intimate mode of origin. In no other organ can the pathogenesis be explained in such a variety of ways. This is proved by histologic findings. Each variety originates in quite a distinctive manner. The genesis of cystic spleen seems to have no points of analogy to the genesis of cysts of the ovary or kidney. In the absence of a tubular structure true retention cysts do not occur. An association has been demonstrated between non-parasitic cysts of the liver and congenital anomalies, especially cystic kidney. There would appear to be no such association in the case of the cysts under discussion.

In 30 of the 43 cases in this series which showed hemorrhagic contents, the history or the pathologic findings indicated a mode of origin. Seventeen resulted from trauma, 3 disintegration (2 from infarction and 2 from arterial

degeneration) Eight were cysts into which secondary hemorrhage had occurred (4 serous, 4 lymphatic) Two were to be regarded as neoplasms (angioma). In this class, then, rupture of blood-vessels, spontaneous or traumatic, figures most conspicuously Spontaneous rupture of diseased blood-vessels and hemorrhagic infarction are more rarely the factors concerned Secondary hemorrhage is of frequent occurrence It is difficult to determine the frequency with which disintegration cysts occur, inasmuch as evidence of ruptured intrasplenic aneurism, diseased blood-vessels, splenic infarction, and embolism would rarely be present after such a process had formed a cyst

In 22 cases analysis showed contents to be serous The large unilocular single cyst may be said to originate secondarily from the subcapsular hæmatoma or intraparenchymatous hemorrhage, the fluid contents of these becoming clear through the deposit of cellular elements upon the walls Eight cases of large, single, isolated unilocular cysts were studied, of which two were thought to develop from hemorrhagic cysts, one from a twisted pedicle and one was thought to be transformed from a multilocular lymphatic cyst through destruction of the interior network In two cases large, single, unilocular cysts were associated with small multiple cysts In three specimens cysts were small, single, and situated deep in the organ Small deep multiple cysts, however, originate in a different manner According to Boettcher they may arise in consequence of amyloid changes which occur in the blood-vessels of the spleen, causing degeneration of the area supplied by them This investigator claims that these degenerated areas subsequently develop into serous cysts He traced an arterial branch to the wall of such a cyst and to a point in the parenchyma which was involved where it suddenly stopped

Beneke is of the opinion that small multiple surface cysts originate from the infoliation of peritoneal endothelium, in consequence of traumatic rupture of the splenic capsule It was claimed by him and his pupil Ramdhor that the splenic tissue protrudes through these ruptures which he terms "hernias of splenic tissue," becomes snared off between

neighboring areas of parenchyma and forms cystic cavities. He considers the cells lining the cysts and the endothelium of the peritoneum identical. M. B. Schmidt also holds Beneke's view and states that these cysts commence as little red excrescences which extend over the surface and appear through the rents in the capsule. Schmidt states that almost all small superficial cysts originate from tissue hernias. He has found many such instances at autopsy in which there had been swelling of the spleen. Wohlwill believes that trauma is not essential to the development of infoliation cysts, but that rupture of the splenic capsule and hernia of the splenic tissue ensue from a rapid swelling of the organ. As the spleen continues to enlarge, rupture takes place at various points, peritoneum becomes turned in and snared off after the manner of a dermoid.

Renggli describes cysts of the spleen lined with cubical epithelium and offers the following explanation in regard to their development. He also attempts to explain the occurrence of deep multiple cysts from snared off peritoneal endothelium. He substitutes inflammation for trauma as a necessary precursor. Renggli believes that in consequence of the fusion of proliferated areas on the surface due to inflammatory processes the endothelium becomes snared off and in situations where such areas have been pressed deep into splenic tissue is stimulated to energetic growth and cyst formation, the cyst coming to lie deep in the parenchyma. He considers that the single layer of cuboidal epithelium lining these cysts is the same as that which composes the peritoneum, except that the peritoneal endothelium of the surface has become flattened from the pressure of neighboring organs. He places the origin of these cysts in the period of embryonic development, when the endothelium of the peritoneal cavity shows its original cuboidal character.

Otto is not of the opinion that deep cysts could arise after the manner of Renggli, but considers that small superficial cysts possessing a flat layer of cells unsurrounded by splenic tissue may have this origin. Ziegler in his text-book of pathology mentions the Renggli theory but states that such cysts are rare. Kuhne has dealt with the subject and reports three cases. In investigating the cause he concludes that the theory of Renggli is quite reasonable and holds good in one of his cases.

Efforts to determine the mode of origin through a study of the lining have not proved successful, for as Aschoff has pointed out the character of the cellular lining is not proof of origin. Endothelium of lymph vessels could be transformed into cuboidal epithelium. It would seem, however, that there is some evidence to substantiate the peritoneal origin in a few individual cases. The theory of Beneke, his pupil Ramdhor, and Schmidt would seem to present a more forced aspect than that of Renggli.

Explanations thus far offered do not make clear the occurrence of extensive multilocular cyst formations. Renggli's theory of inclusions of peritoneum from superficial inflammation would not seem to hold good. A different explanation must be offered for the occurrence of countless fused cysts scattered throughout the organ. These are best explained by the dilatation of the blood or lymph sinuses. Although the intimate nature of these channels is not clearly understood, the origin of multiple, multilocular cysts has been attributed to the lymphatic system. We are indebted to Fink who first recognized this relation. He described several cases. Opinions in support of this origin are held by Kuhne, Aschoff, and Schmidt. The cause of lymphangiectasis is not clearly understood. In twelve cases which were thought to have originated in the lymphatic system various explanations have been offered. Lymphangiectasis may be due to mechanical conditions or inflammatory processes. In no cases however has an interference with the return flow of lymph been demonstrated nor has there been any reason to suppose that an increased supply of lymph had resulted in this condition. Lymph stasis alone would not offer a rational explanation. The conglomerate and multilocular form which these cysts assume is to be explained by the fusion of individual dilatations. Some of these formations have been reported to be lymphangiomas, but whether these are actually new growths or not is an open question. Misplaced lymph vessels or their cells of origin might become snared off during fetal life, proliferate and form such a cystic growth. We know that the spleen is an important if not vital blood-forming organ during the developmental period, and it would appear that extensive changes occurring at this time necessarily interfering with function would hardly permit of life prolonged to an adult age. This would speak against the congenital lymphangioma of the spleen. Fink was successful in proving histologically the transition of dilated lymphatic channels to large cystic cavities. No sharp distinction can be drawn between lymphangiectasis and lymphangioma. The one possibly represents a

sliding scale into the other without a marked transition stage. It has been suggested by M. B. Schmidt that certain pre-formed canals existing in the peritoneal capsule and trabeculæ, which he believes are lymphatic spaces, may form cysts. Schmidt holds in part in this connection to the Beneke theory of traumatic hernia of splenic tissue but believed that lymph cysts develop in this manner from snared off peritoneal endothelium, as well as multiple serous cysts. He has adopted this theory on the ground that some of the little superficial cysts show on their cut surface a cavernous structure and a network of interlacing bands. Kuhne and Jannschita believe that cysts may develop from these lymphatic spaces in peritoneal endothelium and trabeculæ.

*Pathology*—In 43 cases in this series the contents were stated to be hemorrhagic. Seventeen were subcapsular hæmatomas. These are usually large, single, and unilocular (Fig. 2). There is rarely any evidence of a recent or active hemorrhage. The wall of the subperitoneal hæmatoma is composed superficially of the capsule and upon the remaining sides the cyst is surrounded by parenchyma. There is no distinct epithelial lining. The wall is composed of connective tissue if organization has taken place and contents vary according to the age of the cyst. These cysts may contain as much as ten litres of blood, which may be coagulated or fluid, of a black or brown color, depending upon the stage of alteration. The contents usually become fluid, thin, clear, or remain thick. The interior may be irregular and show no definite encapsulating wall, or it may present the appearance of an aneurism. Disintegration of cysts into which hemorrhage has occurred may present necrotic walls and show no evidence of embolism or infarction. Other cysts into which secondary hemorrhage has occurred and angioma need no description. Hæmatoidin and cholesterol crystals are usually present in old cysts. Intraparenchymatous cysts arising from arterial disease may present the characters of the above.

Of 22 cases of serous cysts eight were small superficial multiple cysts (four of these were multilocular). Two cases

of large isolated cysts were associated with small multiple cysts. Eight were large solitary cysts with a single cavity

Small superficial cysts with serous contents as described by M B Schmidt are frequently found on the anterior border of the spleen, seldom upon the posterior border or convex surface, and rarely upon the concave surface. These little cysts give the organ a beaded appearance. They do not extend into the parenchyma more than 1 cm. They are about 0.5 cm. in height and seldom more than 1 cm. in diameter. Schmidt states that he has observed many cases post mortem. Mueller found these cysts of the spleen in 11 per cent. in his series of autopsies. These small surface cysts occasionally show bloody contents. They are usually isolated and unilocular. Ramdhor describes in addition deep furrows in the spleen and at the anterior border dense groups of cysts the size of a small pea, tense, and filled with clear fluid and occasionally with mucous, colloid-like substance. He also describes numerous excrescences scattered over the capsule resembling splenic pulp. These hernial projections were covered with a layer of epithelium. In rare instances an interlacing network has been present in the interior of small superficial multiple cysts.

Solitary unilocular cysts with serous contents may be enormous and have been described as large as a foot-ball (Fig 3). They project as a globular mass from the surface and are smooth except for the occasional presence of adhesions. They are usually limited superficially by the splenic capsule beneath which they are situated and partly surrounded by parenchyma. The smaller unilocular cysts may be entirely surrounded by splenic tissue. This is true of those deep lying serous cysts originating from intraparenchymous hemorrhage and pulp degeneration. Those which have been transformed into the serous variety from the subcapsular hæmatoma may show a smooth interior of organized connective tissue from the deposit of cellular material and fibrin. The walls may appear smooth, laminated, rough, or irregular. The interior never shows an epithelial lining but occasionally a layer of fibro-

blasts or round cells Boetcher describes multiple serous cysts within the parenchyma, from the size of poppy to that of hemp seed He states that the pulp in his case was infiltrated and the capsule thickened The vessels and connective tissue showed amyloid degeneration The cysts were close together The smaller ones contained in addition to serum fat and fibrin The walls showed an endothelial lining separated by splenic tissue and a fibrinous septum In places cavities merged into each other The vessel walls were greatly thickened by amyloid changes and constricted

In twelve cases the diagnosis of lymphatic cysts or lymphangioma has been made in this series In some instances findings are at variance with our conception of these cysts In the case of lymphatic cysts, resulting from lymphangiectasis, the organ is enlarged as a whole Coenen has designated this condition polycystic degeneration( Fig 4) Lymphangiectatic cysts have been described by Coenen and myself The surface is irregular and the seat of countless projections The cut surface shows innumerable cavities, some isolated, others confluent The latter in their interior present an interlacing network giving the characteristic appearance of a multilocular cavity The cyst walls in places may be in immediate contact or there may be a small amount of splenic tissue between them Aspiration of these cavities before fixation of the organ and coagulation of their contents shows a fluid presenting the characteristics of lymph It is usually a clear fluid of high specific gravity and high percentage of albumin After fixation this material coagulates into homogeneous masses which stain a pink color with eosin Microscopic examination shows lymph or blood sinuses in various degrees of dilatation, which range in size from the slightly dilated channel to large cystic cavities The smaller cavities usually show no endothelial lining The larger show a delicate connective-tissue wall and an endothelial lining which may show degeneration at various points In some places it would appear that this lining has become retracted from the wall and adherent to the coagulated lymph Cellular contents are usually present Hemorrhages are prone to occur

into the larger cavities. The above description would hold for a lymphangioma were the process a localized conglomerate mass such as Fink has described at the hilum of the spleen. In these cases the organ itself is not materially enlarged.

*Symptomatology*—Clinically, the most frequently recognized cyst is the large unilocular variety of hemorrhagic or serous type containing from one to ten litres. Intermittent or continuous extravasations of blood are never sufficient to cause symptoms of internal hemorrhage.

In general terms symptomatology is simple. In the absence of any apparent function of the adult spleen there are no symptoms which are present as the direct result of the involvement of the splenic tissue *per se*. When cysts are small there are no symptoms. The small cysts have been accidental post-mortem findings. Large cysts usually cause symptoms from pressure. A low grade inflammation causes adhesions, which in turn may also result in symptoms. Intense peritoneal reaction may excite severe pain, vomiting, and fever. In not a few cases have acute symptoms brought the patient to the physician. The predominant symptom is pain. It may express itself as a feeling of heaviness and be of a dragging character. It is located in the left hypochondrium or referred to the epigastrium. A number of these cases have been mistaken for movable kidney, so closely have the symptoms imitated this condition. If the spleen is dislocated pain may be experienced in any part of the abdomen and radiate to the hypochondrium. The chief symptoms are from pressure. Digestive disturbances have been very frequently observed as a result of this. The stomach and intestines suffer from disturbed function by being crowded downward and to the right. Dyspnoea and circulatory disturbances are more rarely present from upward pressure upon the diaphragm. Obstinate constipation has been observed, more rarely diarrhoea. Frequently the patient has first observed the presence of an abdominal tumor which has gradually increased in size without pain (Heautreaux, Monnier, Routier, Wells). Growth is usually slow. In other cases reported mild repeated attacks of pain



or dyspepsia have been the rule, or a long latent period has resulted in a sudden severe outbreak. Occasionally symptoms of collapse have occurred from a twisted pedicle. Loss of weight and strength have not been observed until the growth is large.

The tumor is usually located to the left of the umbilicus. A cyst of large size may extend from the lower border of the ribs to the median line and below the navel. Percussion reveals a mass continuous with splenic dulness. The mass may be freely movable or fixed. The surface may be smooth, irregular, of doughy or elastic consistency. Fluctuation is not always present. Monnier has drawn attention to a friction sound which results from perisplenitis. It indicates the presence of adhesions and is of no especial diagnostic value. There is usually no ascites except in the case of new growths.

*Diagnosis* of cyst of the spleen has rarely been made clinically. Many have been recognized post mortem. The previous history of the patient is of the utmost importance. Careful inquiry must be made in regard to trauma, the rapidity of growth, its situation when first observed, the direction of growth, and character and site of pain. The laboratory, X-ray and ureteral catheterization may be useful in excluding other conditions. The most decisive symptom is the discovery of a tumor in the left hypochondrium which presents the characteristics of a cyst. Other abdominal cysts are of much more frequent occurrence, and must be excluded before a cyst of the spleen may be diagnosed. The diagnosis of enlargement of the spleen only may be made. It is usually not difficult. It may not be possible to appreciate the fact that the tumor is cystic. Puncture through the abdominal wall for diagnosis is never justifiable unless the abdomen is to be immediately opened thereafter. All other more common causes for splenic enlargement must first be ruled out. A more refined diagnosis than that of abdominal cyst or splenic enlargement can rarely be made. Cysts of the spleen must be differentiated from cysts of the omentum, pancreas, mesentery and left lobe of the liver. If the cystic spleen is displaced into the pelvis

Cysts of the spleen may be classified as dermoid cysts, parasitic cysts, and non-parasitic cysts. There is a single recorded case of a dermoid of the spleen. It was reported by Andral in 1829. Full details of the case are lacking, but it was said to contain hair and sebaceous material. The occurrence of a dermoid in this organ may be explained by implantation from an ovarian tumor of this nature. It may also be explained by the inclusion of these epithelial elements in the spleen during fetal life.

Parasitic cysts are uncommon. *Echinococcus* is the most frequent variety, and occurs in regions where hydatid disease prevails. The spleen was involved in 2 per cent of cases of hydatid disease which Thomas studied. He collected 88 cases in which the spleen was affected. In 45 of these the spleen alone was involved. The cysts may be unilocular or multilocular, single or multiple (Fig 1). They may be situated anywhere in the organ. The mode of entrance of echinococci into the spleen is of interest. Leukart has found them in the portal circulation, which explains their entrance into the liver. This is the site of predilection, but to gain entrance into the spleen by this route the embryos would have to go against the blood stream. A possible explanation is that after being freed from the capsule by the action of the digestive juices they traverse the gastric and intestinal walls by boring or pushing their way directly into the spleen where this organ is in relation with the stomach and colon. They may push their way through actual or potential spaces, or they may travel in the lymphatics. The extreme rarity with which the embryos are found in the lymph-glands and vessels speaks against lymphatic transference.

Cysts of non-parasitic origin are of especial interest, and it is this variety with which we are chiefly concerned. The present contribution is an analysis of all the available cases, products of both the autopsy table and surgical clinics which have been published up to 1912. Abstracts of these cases are to be found at the conclusion of the monograph. Subdivisions of this variety have been classified as hemorrhagic, serous, and

clamp at the hilum. Partial splenectomy (excision of the cyst-bearing tissue) is rarely justifiable. This procedure is attended with grave danger from hemorrhage. It has been accomplished by Bircher, who controlled hemorrhage by interrupted sutures placed around the cyst. It has been successfully performed by Gussenbauer. It must be regarded as a very formidable operation as these cysts are rarely if ever pedunculated.

Splenectomy is the treatment of choice in cases in which the operation is not contraindicated by the presence of extensive adhesions. If there is polycystic degeneration (Coenen, Fowler), or if the spleen is otherwise extensively affected by pre-existing disease (malaria), or if the spleen is materially enlarged as a result of the cyst, if there is displacement, elongation of the pedicle with danger of torsion, excision of the spleen is the best treatment.

Pean was the first to perform splenectomy for cyst (1867). Johnson in an admirable monograph upon splenectomy has collected from various sources 19 cases of cysts which were treated in this way without mortality. All these cases occurred prior to January, 1908. Three cases in Johnson's series are not included in my list of splenectomy cases (Bacelli, Israel and Gerard). The case of Hedinger, reported in 1906, was overlooked by Johnson. In all I have been able to obtain data of 27 cases of cystic spleen treated by splenectomy up to 1912. The operative result is not stated in two cases (Royster, Boechelman). One died, Homans (angio-sarcoma?), 24 recovered.

In selected cases permanent recovery may be secured by less radical means. The subsequent changes, glandular swelling, lymphatic and thyroid, leucocytosis, and other transient post-operative phenomena are, however, not of sufficient gravity to contraindicate the removal of the spleen. The less radical procedures were undertaken at a time when splenectomy was considered a grave operation and before it was demonstrated that excision was not followed by serious impairment of the general health.

it may easily be mistaken for an ovarian cyst or floating kidney. Adhesions may occur between the uterus and the dislocated spleen and further simulate tumors of adnexal origin.

*Treatment*—Cysts of the spleen have been treated surgically by (1) puncture, (2) incision and drainage, (3) excision, and by (4) splenectomy. Eight cases received treatment by puncture. In this series diagnosis of the character of the cyst was dependent upon examination of the aspirated fluid. Four of these were said to have recovered. One death was caused by the operation. It was due to peritonitis and followed the injection of iodine. Reaccumulation of fluid took place in two cases. The fourth case which remained uncured resulted in a persistent sinus. Puncture and subsequent injection does not afford a complete cure and is a dangerous, unsurgical procedure. Within recent years it has not been performed. The last time was in 1898, by Reimann. His patient refused more radical treatment.

Fourteen cases were treated by incision and drainage. The result is unstated in five cases, seven recovered, two died. Healing has been protracted and occurred in from three months to one year. Causes of death were sepsis (Powers) and peritonitis and splenitis (Quintard and Pean). This method has been preceded in a number of cases by exploratory puncture before laparotomy. Various methods of drainage have been used, tampons in two cases, marsupialization in three. A two-stage operation has been performed. Following laparotomy and the establishment of adhesions between parietal peritoneum and cyst wall, incision is made and contents drained. This is an advisable procedure in case of parasitic cysts if no more radical treatment is possible.

Excision of the cyst has been practised six times. Four recovered, one died, result unstated in one. The cause of death in Bircher's case was post-operative intestinal obstruction from pressure by the spleen. No difficulty may be encountered in excising the walls of the cyst if it is subcapsular. Radical treatment of the floor of the cyst may be effected by cauterization (Bardenheuer). Hemorrhage may be controlled by

of the spleen A boundary of splenic tissue cannot be demonstrated in this situation

FOERSTER Spleen in the Wurtzburg collection Serous cyst size of a hazel-nut with thick cartilaginous walls

GAUGET Male, aged 46 Died in collapse History of alcoholism, dyspnœa on exertion Spleen enlarged, contained yellowish fluid in rounded regular pockets, size of a hen's egg and walnut

GUIO and VINARDI Calcified cyst of the spleen the size of a small nut containing albuminous fluid which effervesced in hydrochloric acid

IIARNETT (1907) Male, aged 40, history of malaria Lues negative Suppurating aneurism of the popliteal artery, arteriosclerosis Enormous unilocular cyst 10X6 inches containing a pint of dark altered blood Unsuccessful attempts to locate a branch of the splenic artery entering the cyst cavity were made Slight fibrosis, large amount of free iron in pigment Slight amyloid degeneration of trabeculae Outer layer of cyst wall fibromuscular, middle composed of splenic tissue, inner fibrous, no cell lining

HASWELL Male, aged 57 Died of cancer Sense of fulness and fluctuation noticed in the left hypochondrium before death Spleen and cyst weighed three and three-quarters pounds On opening same, pul-taceous matter escaped of dirty yellow color in rounded masses Among them were round jelly-like globules the size of a walnut which contained a clear fluid (echinococcus?) Diagnosis, mucus cyst

HUNTERIAN MUSEUM of the Royal College of Surgeons One specimen of hemorrhagic cyst of the spleen, one serous cyst of spleen of an ox

KLIFFEL and LEFAS (1898) Male, aged 72 Death from chronic meningitis and myelitis Cysts in the kidneys Senile alterations in the vascular system Spleen weighed 235 Grams At the anterior border a cyst the size of a large nut, containing clear, yellow fluid Inner surface whitish, in places ecchymotic The cut surface showed an appearance similar to the ventricles of the heart Within the parenchyma was another cyst the size of a small nut which was easily enucleated Its walls were thin and greyish-white Contents clear, light red Microscopic examination showed walls to be composed of connective tissue 1 mm in thickness, small round cells in places No endothelial lining Splenic parenchyma normal

KUHNE Three cases In two cases the cysts were situated beneath the capsule In one case the cyst lay in a trabeculum and its wall was lined with endothelium The third case resembled that described by Renggh On the capsule were found countless projections of connective tissue rich in blood-vessels The small cysts lay close together The cysts were lined with high epithelium, contents consisted of homogenous, granular material with a few round cells The first two were diagnosed lymphatic cysts, the third he believed originated from snared off peritoneal endothelium

LANGHANS (1879) Pulsating, cavernous hemangioma. Male, aged 30 Stroma fibrous Interstices lined with endothelium Contents con-  
-pated of blood

ABSTRACTS OF CASES OF NON-PARASITIC CYSTS OF THE SPLEEN WHICH  
HAVE BEEN FOUND POST MORTEM

ANDRAL (1829) Spleen contained small cysts filled with serous fluid scattered throughout the organ, isolated and confluent. Resembled formations seen in cystic cervicitis of the uterus.

BARBACCI (1891) Cyst of the spleen the size of a hen's egg contained transparent, viscid fluid the color of gold, fibrinous coagulum, and albumin. This was diagnosed a lymphatic cyst.

BEDNAR (1850) Small cyst in a child of one week born with pemphigus.

BOETTCHER (1870) Multiple serous cysts the size of a flaxseed to that of a pea. Some traversed by trabeculae, lined with endothelium.

CHAVIER (1902) Male. Seventeen months previously received a blow in the region of the spleen. Digestive disturbances followed, later an attack of sudden severe abdominal pain with tympanites, diagnosed intestinal obstruction. Death in two days. At autopsy a tumor the size of a Savoy biscuit was found in the left hypochondrium which originated from the spleen and rested upon the anterior wall of the stomach. The cyst was compressed, and in contact with the abdominal wall, extended forward under the false ribs, inward three inches beyond the median line and downward to the level of the navel. There were no adhesions. Cyst thought to originate from subcapsular hemorrhage. Contained 1870 Grams of reddish-brown fluid. Spleen weighed 500 Grams. The interior of the sac was covered with reddish fibrinous deposit, commencing organization. The spleen pulp was very soft. Rupture of the stomach.

FINK (1890) Three cases. (a) Male aged 48. Spleen was occupied upon its convex surface by countless projections of varied shape and size. Spleen slightly enlarged. Section showed cystic cavities intermingled with apparently normal splenic tissue. Most of the spaces were filled with yellowish-red masses. The walls of the cavities possessed numerous projecting ridges. Cavities were separated by bands of connective tissue. The interior of the cavities was lined with endothelium. Contents consisted of homogeneous masses, fine and coarse granular detritus, and here and there a lymphoid cell. (b) In the museum of the Pathologic Institute in Prague. Spleen enlarged a trifle. Numerous projections the size of a cherry pit and larger were scattered over the convex surface, especially on the borders. The cut surface is similar to Case I. In but few places could the character of the lining be recognized. Contents similar to Case I. (c) Upon the anterior portion of the spleen was found a cyst as large as a hen's egg. Contents clear, cholesterol crystals. Walls consisted of thin fibrous membrane (epithelial lining washed off by the alcohol?). In the region of the cyst the endothelium lining the lymph spaces was slightly degenerated. In this case destruction of the connective-tissue bands of the interior of the cyst had occurred, resulting in a single cavity. In the splenic tissue which showed little change there was a sharp demarcation between cyst and parenchyma. The convexity of the cyst is formed by the capsular peri-

enced pain, which was sudden and severe. This passed off quickly but returned in a few days with greater severity. Pain ceased in two months, but patient noticed at this time a growth in the left hypochondrium which slowly increased in size. The surface of the growth was smooth, consistency soft, elastic, and distinctly fluctuating. The mass was freely movable, painless, and adherent to the lower pole of the spleen. Two exploratory punctures liberated blood. The swelling disappeared for one month, when fluid re-accumulated. Thought to be sub-capsular hemorrhage.

CUTLIFFE Male, aged 40. Intermittent fever for four months. Enlarged spleen. Acute hypochondriac pain and swelling under the ribs on the left side of twelve days' duration. Tumor hard, not tender. Later fluctuation. Puncture liberated degenerated blood. Recovery.

GARCIA Male, aged 36. Syphilis six years previously. Tertian fever cured by quinine. Fall from a horse caused an abdominal contusion, followed in one month by local pain, indigestion, and constipation. Tumor in the left hypochondrium. Puncture liberated odorless gas and tumor diminished in size. On the following day a second puncture liberated one quart of clear, transparent, white wine-colored fluid, specific gravity 1004. Contained albumin and sodium chloride. A third puncture in three months, 300 Grams of fluid obtained. Recovery.

MARCANO and FERREAL Male, aged 33. Malaria for some years. At this time splenic enlargement. Dyspepsia. Two years ago nausea and vomiting after meals. Fluctuating tumor in the epigastrium and left hypochondrium. Puncture resulted in the withdrawal of 300 Grams of chocolate colored fluid, containing blood-cells. Treated by injections of iodine and potassium permanganate. Recovery. Three months later a small fistula about 7 cm deep still persisted.

GUILIANO Male, aged 33. Malaria. Six months previously injury over the left hypochondrium. Puncture liberated degenerated blood.

PEAN and ROUSET (1863) Female, aged 7. Serosanguineous cyst diagnosed by puncture, treated by caustics. Death in two months from peritonitis.

REIMANN (1901) Female, aged 33. Weakness and pain in the left side and lumbar region. No infectious diseases. Tumor corresponded with the enlarged spleen. Heart pushed to the right. In 1898 exploratory puncture liberated chocolate colored fluid which contained albumin, detritus, red blood-cells, and was rich in cholesterol. Second puncture ten days later, 2400 cc withdrawn. Swelling entirely disappeared, heart returned to the left. Cyst soon refilled. Repeated punctures. Operation refused. Patient discharged uncured.

VERNEUIL states that he has seen four cases of hemorrhagic cyst of the spleen, three of which have been cured by trocar.

#### ABSTRACTS OF CASES WHICH HAVE BEEN TREATED BY EXCISION AND DRAINAGE

BAGINSKY (1898) Female, aged 13. Swelling of the left side shortly after she had fallen directly upon the abdomen. In the left hypochondrium an elastic fluctuating growth extended over the median

line to the right, the lower edge a little below the umbilicus Exploratory puncture, turbid brown fluid containing numerous red blood-corpuscles, partly degenerated, a colorless stroma, sparkling globules, and cholesterin Blood examination normal Operation by Gluck Incision made over the cyst, contents emptied and iodoform gauze tampon placed in the cavity Cure in 16 weeks Chemical and microscopic analysis showed contents to be altered blood When wound had healed spleen was still enlarged and firm A fragment from the cyst wall showed connective tissue and splenic parenchyma

BARADULIN (1906) Male, aged 34 Trauma four years previously Diagnosis, hemorrhagic cyst Incision liberated 3000 Grams of fluid blood Healing in five months

BOCCHIA Male, aged 24 Traumatism over the spleen six years before Splenic enlargement for three and one half years Puncture resulted in the removal of dense chocolate colored alkaline fluid Next day cyst was evacuated by incision, when 2140 Grams of fluid were removed Recovery

DARLING, C G Female, aged 18 When 15 years of age sudden severe pain in the left side Temperature, sweating for one week Splenic enlargement Operation Sac of cyst adherent to the diaphragm and omentum, which prevented excision of spleen Cyst opened and drained, space packed

Downs, A J Female, aged 29 April, 1886, pain in the left side. Confined in 1888 Operation Trocar introduced and large quantity of blood obtained Sac incised, walls of cavity necrotic Cavity drained From time to time portions of necrotic tissue were discharged Discharge of sloughs continued until almost the entire spleen came away Microscopic examination of spleen tissue showed hyperplasia and degeneration of follicles

HEURTAUX (1898) Female, aged 27 Injury eight years previously, later fluctuating tumor Operation Large cyst from which 9¾ litres of chocolate colored fluid were removed Contained cholesterin Cyst opened and cavity curetted, irrigated, and marsupialized Injection of iodoform-ether and chloride of zinc Suppuration Healing in one year Recovery

LEONTE in 1901 reported two cases, both females Treated by marsupialization, both unilocular, serosanguineous cysts Capacity, 1400 and 2000 c c Recovery in both

LEDDEHROSE (1887) Aged 16 Fluctuating tumor of the spleen Operation by Riedel in two stages It had been decided not to open the cyst until adhesions had formed to the parietal peritoneum Spontaneous rupture occurred, liberating a quantity of yellow serous fluid containing cholesterin Wound healed in three months

LEJARS (1901) Female, aged 43 Para vi In 1897 patient fell on the stairs, striking upon the left side May, 1900, severe pain in the epigastrium, vomiting, and diarrhoea During the next six months swelling appeared, pain continued in epigastrium and left hypochondrium December 22, 1900, puncture in the splenic region, brown fluid obtained



Two days later puncture in the epigastrium, fluid of same character January 3, 1901, chill, fever, and vomiting Tumor tense and sensitive January 5, incision in the lumbar region One and one half litres of fluid obtained Wall of sac covered with dark, brittle, regular formation, and particles of fibrin Sac irrigated and drained Lejars believed that hemorrhage was responsible for the formation of the cyst and that the walls were composed of splenic capsule

POWERS, C A Male, aged 18 Large left-sided abdominal cyst of four years' growth Gradual loss of weight and strength, general pressure symptoms, and headache Operation Wall of tumor was one-half inch in thickness, semicartilaginous and adherent to adjoining structures Removal impossible Incision and drainage Walls did not collapse Patient died of sepsis on the twelfth day Anatomical diagnosis, unilocular, hemorrhagic cyst of the spleen

QUINTARD and PEAN (1879) Female, aged 53 Hemorrhagic cyst treated by caustic Death following opening of the cyst from splenitis and peritonitis

SUBBOTIC Two cases (a) Male, aged 30 Beneath the ribs upon the left side protruded a growth the size of a man's head Incised and 1500 cc of fluid obtained Adhesions between the tumor and abdominal wall Peritoneal cavity was not opened Contents composed only of altered blood-cells Interior of cyst cavity was smooth, walls tough The cyst was situated upon the spleen and occupied a portion of the interior of the organ (b) Male, aged 21 Growth larger than a man's head Situated beneath the left costal arch and extended to the right mammary line Incision, bloody fluid evacuated The anterior wall of the cyst was about an inch and a half in thickness There were many hard adherent coagula in the cavity

#### ABSTRACTS OF CASES WHICH HAVE BEEN TREATED BY INCISION AND PARTIAL SPLENECTOMY

BARDENHEUER (1890) Male, aged 47 Traumatism at seven years Symptoms of low abdominal pain referred to the left hypochondrium, marked digestive disturbances, severe gastric pain, eructations, vomiting, a feeling of violent tearing in the epigastrium, and obstinate constipation At the time of operation the cyst was the size of a child's head, adherent in the pelvis Spleen incised, hemorrhage controlled by clamp at the hilum and by cauterization in the parenchyma Excision of cyst Spleen returned to normal position Recovery The convex surface of the spleen was atrophied and merged into the wall of the cyst immediately under the spleen, which was 2 mm thick The surface of the cyst was smooth except in a few places where there evidently had been adhesions to the surrounding tissues In the upper portion of the cyst where it came in contact with the atrophied parenchyma of the spleen there was hard calcium deposit in the wall The interior of the cyst showed many strands of connective tissue in the form of flat bands which interlaced to form a network. The wall consisted of connective tissue

in which there was embedded blood pigment and calcium. No epithelial lining was evident. The splenic parenchyma was more than half atrophied and merged gradually into the cyst wall. Contents thin and of dirty brown color. Microscopic examination showed considerable blood pigment and cholesterol crystals.

**BIRCHER (1907)** Female, aged 34. Spring of 1903, edema of the right leg, pain in the lower abdomen. August, normal labor, healthy child. Delivered by midwife who found "something" to one side of the uterus. Tumor of the abdomen which occupied the false pelvis, elastic and fluctuating. Diagnosed an ovarian cyst. Operation. Cystic tumor of the spleen appeared upon incising the peritoneum. Dark brown, thick, flaky fluid removed by trocar. Wall of cyst 7 cm thick, composed of connective tissue and parenchyma. Spleen enlarged to six times its normal volume. Interrupted sutures placed around the cyst and that portion excised. The pedicle was found twisted 360 degrees, thick and elongated, allowing dislocation of the organ in the pelvis. Wound closed with drainage. Patient developed intestinal obstruction and died in three days. Autopsy showed that the small intestine was compressed by the spleen where an adhesion had formed. Microscopic examination of the cyst wall showed necrotic tissue. Examination of the pulp showed an acute inflammation. The twisted pedicle was not held responsible for the cyst formation but rather an hemorrhagic infarction.

**FINK (1890)** Male, aged 14. Rapidly increasing growth in the left side, pain in the region of the spleen. Examination revealed an oblong, rounded mass which extended from the left border of the ribs to the mid line and a hand's breadth below the navel. It was soft, elastic, and movable. Laparotomy by Guessenbauer in 1888. Median incision. The spleen exposed and at its lower pole upon the surface there was a glistening, white growth as large as a child's head. The upper half of spleen appeared normal, division between growth and spleen was marked. Partial splenectomy, recovery. Six months later patient in good health. No leucocytosis, swelling of the glands, or pain in the bones. Thyroid not enlarged. Pathologic report. The cyst was emptied of 1500 Grams of reddish-yellow fluid, composed of red blood-cells, leucocytes and cholesterol. The wall was composed of a fibrous membrane 3 or 4 mm thick, was reddish-brown in color, of uniform structure, and had a smooth interior. The interior was so constructed that irregular trabeculae and broad glistening bands interlaced to form a system of cavities. The wall consisted of connective tissue. The spaces possessed no characteristic epithelial lining, except in about one-third the spaces which were interpreted as lymph spaces. These showed a delicate endothelium with beginning degeneration at various points. Fink considered this formation a lymphatic cyst which developed from the dilatation of the lymph channels.

**FEREAL** Female, aged 33. During an attack of mumps, which preceded pain in the left side, an abdominal tumor formed the size of a fist, to the left of the umbilicus. Movable. Operation. Excision of

cyst and cauterization Many adhesions Cyst contained black fluid, blood-clots

HUNTINGTON, T W Female, aged 21 Digestive disturbances Tumor in the left upper abdomen when 19 No traumatism Operation Cyst wall covered with omentum Two gallons of dark fluid withdrawn Cyst arose from the convex surface Spleen lay upon the upper segment of the cyst like an inverted clam shell Large venous sinuses passed over the spleen and were widely distributed over the cyst wall Excision of distal portion of sac and marsupialization Recovery Cyst wall thin, composed of fibrous tissue On the inner surface small attached cysts which contained clear serous fluid

Anatomic diagnosis serous lymph variety, secondary hemorrhage

TERRIER (1892) Female, aged 33 Para iii Pain in left side of abdomen, enlargement of the abdomen Tumor, size of a fist, half above and half below the navel, extended 4 cm to the right and 10 cm to the left of the mid line, consistence of firm dough Above and to the left a broad hard pedicle could be felt extending toward the ribs Operation Median incision Small intestine, stomach, omentum being pushed to one side, a round reddish-brown tumor became visible Puncture showed bloody contents The cyst wall burst and dark fluid escaped The cyst was subcapsular, and occupied the concave surface The wall of the cyst was excised, floor cauterized Recovery The fluid contained in the cyst consisted of fibrin, blood-cells, and serum Wall was composed of connective tissue and calcium deposits Inner surface rough, covered with fibrin Post-operative examination revealed a spleen slightly enlarged and sensitive to pressure

#### ABSTRACTS OF CASES OF NON-PARASITIC CYSTS OF THE SPLEEN WHICH HAVE BEEN TREATED BY SPLENECTOMY

BOECKELMANN reports a case of hemorrhagic lymphangioma of the spleen removed from a child fifteen months old The patient in addition suffered from multiple skin and mucous membrane angiomas The tumor was clearly distinguishable from the splenic tissue

BRYAN, W A Female, aged 39 Operation splenectomy, recovery Spleen adherent to mesocolon Upon severing vessels at the hilum cystic fluid escaped Wound drained for a few days in ignorance of the character of the cyst Pathologic report Cyst wall thin in places Large intercommunicating pockets obliterated the splenic substance except for an ounce or two Weight two and one-half pounds Fluid clear and colorless, specific gravity 1006 No hooklets or albumin No epithelial lining to cavity, smooth, glistening, and easily separated from surrounding tissue Wall laminated and contained a small amount of smooth muscle tissue History of malaria only possible etiologic factor

COENEN, H Removed the spleen from a woman in the course of pregnancy There was no ascites Tumor observed after the birth of her last child Weight of excised organ 2565 Grams, 715 Grams of yellow fluid escaped on section The organ was 33 cm in length, 20 cm in

breadth, 10 cm in thickness, of grayish-blue color, and distinctly knobbed. The projections were largest at the poles and on the concave surface. They proved to be thin walled cysts which in places were composed of the capsule only. On section the organ presented a honeycombed appearance. It was riddled with smooth walled cysts which varied in size. The interior of the cysts was gray, smooth and glistening, and traversed by trabeculae. A few cavities contained fresh blood. Most of them contained a clear watery fluid. By pressure upon the organ the fluid in distant lying cysts was moved so that we might assume that all were in communication. In the sections little normal splenic tissue could be demonstrated. Where pulp remained it was in a state of chronic inflammation. Here and there were to be seen a few follicles. Except for this the entire organ was transformed into cystic cavities. The cysts in places were separated only by a thin connective-tissue septum. The contents were homogeneous masses staining well with eosin, in which were scattered a few lymphocytes. Coenen speaks of this condition as one of lymphangiectasis.

CREDE (1883) Male, aged 44. Injury ten years previously. Suffered pain for five days. Later, swelling size of a fist in the left hypochondrium rapid increase in size to that of a fetal head. Operation, left rectus incision, 1350 Grams of fluid drawn off by puncture, scant supply of albumin, numerous cholesterol crystals. Profuse hemorrhage followed incision into the cyst which was the size of a fifty-cent piece. Wall consisted of a membrane which gradually thickened into splenic tissue. Pedicle ligated, spleen excised. Weight of spleen without cystic fluid, 380 Grams. Parenchyma normal upon microscopic examination. The interior of the cyst showed a structural network interlaced with trabeculae and lined with endothelium. Four weeks after operation swelling of the thyroid. One week after operation leucocytosis. No swelling of lymphatics or pains in the bones. Thyroid swelling disappeared in four and one-half months. Patient in excellent condition ten and one-half months after operation.

DALINGER Female, aged 44. Had malaria for one year. Three days before admission to hospital had an attack of syncope. At operation a thin-walled cyst disclosed extending from the epigastrium to the left hypochondrium. It was adherent to the abdominal wall and diaphragm. Beneath the capsule was a considerable amount of fluid and coagulated blood. Recovery followed splenectomy.

FOWLER, R. H. (1910) Female, aged 22. One year ago the patient fell backward a distance of two and one-half feet. She experienced localized pain upon exertion for a period of three months in the left hypochondrium which was relieved for a time by an abdominal belt. She had not complained of pain for the past six months. Three months previously she was delivered of twins and since that time she complained of experiencing a sensation of something moving during exertion. A probable diagnosis of movable kidney was made and operation advised. Upon opening the abdomen a much enlarged spleen presented. A leucocyte count was made while the patient was under ether and showed

22,000 leucocytes, differential count gave 59 per cent polynuclears, 41 per cent lymphocytes (large and small) Splenectomy by Dr B F Curtis The patient made an uneventful recovery Following splenectomy the leucocytes were as follows Two days after operation, 23,600, polynuclears, 72.5 per cent, lymphocytes, 27.5 per cent Eight days after, 20,200 leucocytes, polynuclears 63 per cent, lymphocytes 37 per cent Seventeen days after, 18,900 leucocytes, polynuclears 74 per cent, lymphocytes 26 per cent Twenty-eight days after operation, 14,200 leucocytes, polynuclears 55 per cent, lymphocytes 41 per cent, eosinophils 2.5 per cent, basophils 1.5 per cent

Pathologic report (Fowler) The gross specimen consists of an enlarged spleen 20 cm in length It is broadest at the poles, where it measures 11 cm The thickness at these points varies between 6 and 7 cm The surface is lobulated, especially at the poles, and there are many small cysts projecting from the surface At the centre of the organ is a constriction, separating the spleen into two quite distinct lobes These are raised 2 or 3 cm above the central constriction The capsule stretches over the entire organ intact The protuberances situated at the extremities are thin walled, project prominently outward, and fluctuate The larger is 7 cm in diameter Upon aspiration a fluid of yellow color, slightly turbid, and of 1030 specific gravity is obtained The fluid showed 6 per cent albumin by weight, no reduction of Fehling's solution and microscopically many red blood-cells The specimen was hardened in formalin and preserved in Kaiserling solution before longitudinal section was made The cut surface shows that the entire organ is cystic The larger cysts are situated at the poles The cysts contain whitish, homogeneous, semisolid masses, the result of coagulation by the fixative When the jelly-like material is removed, the larger cysts are seen to be subdivided The larger protuberance at the upper pole is seen to be composed of two large cysts The smaller of these is smooth in its interior, the other has many projecting edges or septa separating it into many small compartments, giving the appearance of the formation from the fusion of many smaller cysts The other extremity is riddled with intercommunicating pockets of various sizes There is an area of firm tissue fairly free from cysts in the region of the central constriction The cyst wall is extremely thin in places and appears to be composed only of the serosa covering the organ In the interior of the organ splenic tissue is seen to separate the cysts in some cases, while in others the lining membrane of the one appears to be in contact with another The interior of the smaller cysts is for the most part smooth and glistening, and free from falciform projections The weight of the organ exclusive of cystic contents is 385 Grams The vessels at the hilum do not appear thickened There is no demonstrable lymphatic trunk

Microscopic examination The tissue removed was embedded in paraffin and stained with hæmatoxylin and eosin Slide No 1 This piece of tissue was removed from the region of the central constriction and shows no macroscopic cysts The general appearance is that of a dilatation of the lymph sinuses There are many spaces of various size

and shape, some are tortuous and intercommunicating, others are long and arranged in parallel, some are round and others are oval. The entire section is seen to be made up of these spaces surrounded by splenic parenchyma. They possess a delicate membrane of connective tissue which composes the wall, supporting in some instances endothelial cells. In other cases it is not possible to positively identify an endothelial lining. Lymphoid tissue is seen to touch directly upon the membrane in some cases. The contents show for the most part large and small mononuclear leucocytes, with a preponderance of the latter, shreds of fibrin, an occasional eosinophilic and neutrophilic leucocyte and here and there red blood-cells. There are some scattered areas of round cells which appear to represent Malpighian bodies. These follicles show some hyperplasia, otherwise no change. The arterioles show normal walls. In some follicles they are situated eccentrically, others show two vessels peripherally located. The blood-vessels in other situations in this slide appear normal. The connective-tissue trabeculae are somewhat increased. In some situations they are seen to contain dilated spaces lined with endothelium and which contain lymphocytes and fibrin. These are taken to be dilated lymphatic vessels. Some of the larger spaces located in the parenchyma show in addition to the delicate membrane of connective tissue alluded to, a wall of connective tissue which appears thicker than that composing the wall of the smaller spaces. The wall is infiltrated with leucocytes and red blood-cells. One or two of the larger spaces, in addition to the cellular contents, are partially occupied by homogeneous, pink staining masses. Slide No 2. This was also removed from the region of the central constriction and shows macroscopic cysts half the size of a split pea. Microscopically there is less dilatation of the lymph sinuses and more cavities. The parenchyma is denser and shows a greater degree of congestion. The several large cysts visible to the naked eye appear under the microscope to possess a definite wall of connective tissue and in some instances an endothelial lining. They are occupied by a smooth, uniform, pink staining mass which has become slightly retracted from the walls. The cells lining these cavities have become separated in places, adhering to the homogeneous material. The walls of some of the larger cysts appear to be made up of connective tissue which has become changed through hyaline-like degeneration. It stains poorly a bluish color. These are to be considered secondary regressive changes. Scattered in and among the lymphocytes are deposits of finely grained blood pigment. The small dilated spaces which correspond to dilated lymph sinuses show cellular contents as described in the first slide and not coagulated masses of lymph. Some of the larger cysts are seen to be surrounded by more connective tissue which appears in elongated bundles and resembles obliquely cut trabeculae. These are to be considered dilated lymphatic vessels lying in trabeculae, they contain homogeneous pink staining masses, which in part have become retracted from the walls, the lining endothelium having become detached and adherent to the homogeneous material. Slide No 3 shows a greater number of small cysts of variable size. Under the microscope countless cavities are seen, large and small, some

are intercommunicating. In some instances they are separated by splenic tissue, in others the lining membrane of each serves to separate them. The majority are irregular in shape, some present finger-like projections or septa, giving the impression that they have been formed from the fusion of smaller ones. Separating the cysts in places are strands of connective tissue, bluish staining fibres showing lymphocytic infiltration. The walls of the largest cysts show them to be composed of this same bluish-staining tissue in addition to the lining endothelium. The walls are denuded of cells in places where they have become loosened and retracted with the homogeneous contents. Some cavities contain the homogeneous material, others this with lymphocytes scattered throughout. The contents of a few show red blood-cells alone, others these with a narrow zone of homogeneous material near the wall. The wall consists of a delicate connective-tissue membrane in case of the smaller cysts in part supporting endothelium. The connective tissue appears degenerated in places. The largest cysts show a thicker wall of connective tissue which has apparently undergone retrogressive changes. The thin membranes of the smaller cysts are in contact in places and show no splenic tissue between them. Slide No 4. Sections were cut of the cyst wall of one of the larger cavities. In the gross the lining membranes of two cavities appeared to touch. Under the microscope the wall of each cyst appears to be formed of degenerated connective tissue. The tissue stains poorly a bluish tinge, the fibres seem more or less homogeneous and the nuclei are indistinct. There seems to be no endothelium present except in one place where the contents have become separated from the wall, retracting with it a few endothelial cells. There is deeply congested splenic parenchyma between the walls of the cysts. The lymphoid tissue is somewhat separated here, giving much the same appearance as that interpreted in Slide No 1 as a general dilatation of the lymph sinuses. These are filled with coagulated masses of lymph and red blood-cells. The blood-vessels in this situation appear normal. Slide No 5. Sections were made at the hilum. The parenchyma here is occupied by a group of about a dozen cysts, they present the same features as hitherto described. In addition to these large cavities may be seen a dilatation of the lymph sinuses. This occupies the area immediately surrounding the cysts. There are two vessels—one is taken to be the splenic artery. It shows a much degenerated intima taking a bluish stain. There appears to have been some thickening. In some instances intima is absent. The internal elastic coat stands out distinctly. The degeneration seems to have invaded the media, as shown by scattered areas of bluish-staining tissue. The adventitia shows a similar degeneration, fibres and nuclei are indistinct. The lumen is occupied by coagulated masses and blood. It is not possible to identify the other structure. It is almost as large as the artery and probably is a vein. The wall about half as thick as the artery shows smooth muscle fibres and degenerated connective tissue. No intima or definite coats can be made out.

HOMANS operated upon a woman of 23 who had signs of increasing ascites for a year. She had been previously tapped and bloody fluid

obtained At operation an abdominal tumor was removed from the transverse colon It was covered with omentum, and represented a spongy, fibrous mass diagnosed by Whitney as a cavernous argioma possibly originating in the omentum The fluid re-accumulated and four months later another operation was performed The spleen was removed It was enlarged and of normal shape, weight 415 Grams There were numerous purple elevated areas upon the surface Section showed a fibrous network filled with reddish and light colored fluid Microscopic examination showed areas of blood and transparent coagulated masses in a cavernous structure The walls were formed of thin connective tissue with an endothelial lining

HEDINGER (1906) demonstrated a specimen before the German Pathological Society The young girl was thought to suffer from hydronephrosis Trauma two years previous to operation Splenectomy Tumor of the spleen contained fluid, no free bodies Wall of connective tissue Recovery

HEINRICIUS Male, aged 14 Hard, abdominal tumor in the umbilical region for one month Operation Large blue-gray mass adherent to displaced spleen It arose from the outer side Splenectomy Pathologic report Cyst contained 800 c c brownish-yellow, flaky, sticky fluid, cholesterol crystals, leucocytes, red blood-cells, and detritus Wall of cyst toward the lower pole thin as paper, pale yellow, 3 cm in thickness, and increased in size and thickness to a point where it arose from the spleen At this point the color resembled that of the spleen The size of the cyst was that of the head of a new-born child The spleen retained its original shape, cyst arose from the outer and under portion Wall of the cyst lined with endothelium Considered a lymphatic cyst

JORDAN (1903) Female, aged 46 Operation splenectomy Hæmatoma, weight four kilograms Recovery

KUSTNER, Otto (1911) Female, aged 39 Noticed a tumor the size of a head in the left hypochondriac region which had caused considerable pain This condition had existed for two years, when Kustner decided to extirpate what he considered a cyst of the spleen Recovery Patient discharged on the sixteenth day after operation Blood count 23,000 leucocytes, 6,000,000 erythrocytes, hæmoglobin 72 per cent Three and one-quarter years after operation the patient is well and able to carry on her work No nutritional disturbances or gland swellings Four-fifths of the spleen in this case was occupied by the cyst, which contained a sulphur-yellow fluid Echinococcus was ruled out It was suggested that a twisted pedicle was responsible for the formation

LEONTE Female, aged 55 Tumor in the epigastric region diagnosed a cyst of the gastrosplenic omentum At operation a unilocular cyst of the spleen was found Spleen much shrunken Splenectomy

MINERVINI Female, aged 14 Immovable fluctuating tumor larger than a head Splenectomy Serosanguineous Recovery

MONNIER Female, aged 21 General and local symptoms Bulging tumor of the hypochondrium, moved with respiration Friction murmur Operation by Kronlein Splenectomy Cyst of the upper part of the



spleen adherent to surrounding parts Capacity of cyst  $3\frac{1}{2}$  litres of bloody fluid Recovery

McMURTRY Female, aged 30 A freely movable abdominal tumor could be displaced to any part of the cavity Receded toward the diaphragm upon lying down, descended to the pubis upon assuming an erect posture Diagnosis ovarian cyst or movable kidney Operation Splenectomy Pathologic report Splenic tissue comparatively healthy in appearance Large cyst chief departure from the normal

MICHAILOWSKY (1900) Female, aged 12 History of trauma and malaria Splenectomy Spleen seat of a large unilocular cyst

MORESCHI and GIETTI Female, aged 42 Indefinite pain in the left side for more than a year Prong of a pitchfork pierced the left side, where a painful swelling appeared which gradually increased in size In a month the spleen was found to be enlarged, displaced, and fluctuating Operation Adhesions between ascending colon and cyst Splenectomy, recovery Pathologic report Organ  $29 \times 23$  cm Weight, 1315 Grams Cyst occupied the anterior border of the spleen and contained 950 cc of dark fluid Spleen tissue normal Wall of cyst composed of connective tissue with epithelial lining

MUSSER (1911) Female, aged 25 First noticed abdominal swelling in the splenic region when 18 years of age Since this time mass has grown downward and into the pelvis Rapid growth for past year No injury Soreness over tumor, slight nausea No change in general health up to one year ago, when she became weak and bowels constipated Mitral systolic murmur at the cardiac apex Tumor largest and most prominent in the epigastrium Hard, fluctuating, moved with respiration A few small discrete lymph-nodes in the cervical chain and in the inguinal region Splenectomy by Gibbon Recovery Left upper rectus incision Large cyst adherent to the diaphragm and surrounded except in this situation by splenic tissue Freed and tapped, 100 ounces of clear, yellow fluid obtained Considerable bleeding after freeing adhesions Pathologic report Weight of specimen 400 Grams Upper posterior region, huge cyst the size of a foot-ball, single cavity, open and collapsed Surrounded on three sides by splenic tissue Spleen is enlarged, surface smooth Microscopic examination Sinuses show some increase in connective tissue in places Tissue very cellular Malpighian bodies large, germinal centres swollen An occasional uninuclear giant-cell at the periphery No cellular lining in the wall Anatomical diagnosis, unilocular serous cyst arising in the capsule or splenic pulp

PÉAN (1880) Female, aged 20 Two years ago swelling and pain in the hypogastrium Acute pains for two months Hard, fixed, partly fluctuating tumor of the abdomen Diagnosed an ovarian cyst Operation, median incision, tumor adherent to omentum Brownish-yellow fluid from puncture Adhesions freed, spleen excised Recovery Spleen presented the characteristic color of an hypertrophied spleen, weight 1140 Grams Cyst wall of variable thickness, thin in places, where it consisted of connective tissue In thicker places it was composed of splenic tissue Cyst unilocular The interior of the wall was smooth and composed of

LEUDET (1853) Female, aged 60 Mitral affection Volume and surface of spleen normal Large cyst in the parenchyma separated into four or five cavities Wall of fibrous tissue lined with endothelium Contents, serous

LIVOIS (1838) Male, aged 46 Tertian malaria Greatly enlarged spleen containing cyst the size of an ostrich egg Spleen and cyst weighed seven pounds Contents serosanguineous

MATTEI (1885) Male, aged 68 Spleen enlarged, weight 370 Grams Four-fifths of the organ occupied by a tumor the size of an orange, covered in part by the capsule of the spleen The wall was hard, cartilaginous in some places, calcified in others Contents, clear albuminous material Surrounding this cyst were 17 others, ranging in size from that of a hemp-seed to that of a large nut Most of them were filled with serous fluid, cholesterol, granular material, and detritus Leucocytes were found in the smaller cavities The cyst walls of the larger were calcified The walls of the smaller were twice as thick and composed of connective tissue The interior of the large cyst showed two semilunar folds partly calcified This cavity communicated with another medium sized one

PICCINELLI Male, aged 67 Digestive disturbances for thirty years Pain in the left hypochondrium Spleen contained a hard tumor the size of a hen's egg, situated at the hilum and full of knobs, incised with difficulty, escape of viscid gelatinous fluid Diagnosis, ossified, cystic tumor

PORGE Puro-sanguineous, size of a walnut Easily enucleated Contained yellow, grumous, odorless fluid, red blood-cells, pus, and cholesterol

SPILLMAN (1876) Male, aged 51 Tumor the size of a fetal head, which projected from the anterior border and inner surface of the spleen Weight 655 Grams The walls were about 2 mm thick and consisted of spleen substance, connective tissue, calcareous areas, and endothelium Vessels normal Contents 300 Grams of fluid of yellow color containing cholesterol crystals and red blood-cells, deformed epithelial cells, and hæmatoidin crystals

WILKS observed a cyst of the spleen the size of a walnut in an old man who died of chronic nephritis Few small cysts on the surface Contents serous, lining smooth and membranous

Similar specimen to Wilks in Guy's Hospital Museum found in a patient who died of chronic nephritis

VIRCHOW demonstrated a small cyst with tough walls the size of a large cherry in 1898 The contents was cholesterol The spleen was not enlarged He expressed no opinion in regard to its mode of origin In a second specimen observed by him in 1873 multilocular cysts were present

#### NON-PARASITIC CYSTS OF THE SPLEEN WHICH HAVE BEEN TREATED BY PUNCTURE

BACCELLI (1897) Female, aged 27 Came in contact with a cupboard and injured her left side A few days later upon arising she experi-

pedicle there were fused spaces the size of a hen's egg. The interior lining was composed of a delicate, smooth white membrane which showed numerous strands of fan-like septa separating small cavities. The membrane was easily peeled off. The wall of the cyst where it was in direct contact with the spleen could not be differentiated from the organ and could only be separated from it with difficulty.

THORNTON (1886) Female, aged 19. Fluctuating movable tumor in the left side for two years. Operation. Adhesions between omentum and under portion of the spleen. Patient collapsed during ligation of the pedicle. Splenectomy, recovery. Pathologic report. Tumor consisted of a large cyst which contained serum, red blood-cells, and cholesterol. In the upper half of the spleen above the main cysts there were other smaller cysts. The walls were thin, almost transparent in places. Blood examination during convalescence showed leucocytosis. No glandular or thyroid swelling.

WELLS, SPENCER (1889) Female, aged 21. At the age of four had intermittent fever for two years, leaving spleen enlarged. Later tumor evident in ovarian region, round, hard, size of a fist, movable, not adherent to the uterus. Pregnant. Tumor pushed to the left hypochondrium by pregnant uterus. Normal labor. Tumor extended from the navel to the pubes. Patient became very ill, abdomen enlarged, tumor increased in size. Puncture. Five litres of thick, brownish red fluid withdrawn, containing red and white blood-cells. Fluid reaccumulated almost immediately. Operation. Cyst burst during manipulation allowing the escape of four or five litres of fluid similar to that obtained by puncture. Numerous adhesions to the uterus and intestine. A small portion of the cyst wall had to be left behind. Spleen removed. Wound closed without drainage. Wound infection. Recovery.

# PATHOLOGIC DATA OBTAINED FROM ULCERS EXCISED FROM THE ANTERIOR WALL OF THE DUODENUM.

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CHRONIC duodenal ulcers usually occur close to the pylorus and often produce obstruction. When discovered either at operation or autopsy they were formerly believed to be pyloric in origin and were classified with gastric ulcers. In no other way can we account for the frequency with which chronic duodenal ulcer is now found as contrasted with the statistics of a few years ago. The types without obstruction were evidently overlooked except in the rare instances when perforation or hemorrhage brought about a fatal termination of the malady.

In spite of the low mortality and gratifying results following gastro-enterostomy for chronic duodenal ulcer, there must always remain a prejudice against an operation which is indirect and does not actually remove the focus of disease. If, however, obstruction exist, this prejudice is not well founded. The calloused, contracted ulcers with obstruction are ideal cases for gastro-enterostomy, which leaves the patient permanently cured. A number of patients upon whom we performed gastro-enterostomy over fifteen years ago remain in excellent health.

In performing gastro-enterostomy for the cure of duodenal ulcer, the area of the ulcer should be infolded as recommended by Moynihan. The infolding sutures of silk or linen should be applied in a manner to obstruct the entrance to the duodenum and prevent food from entering the ulcerated portion. As a rule we place an obstructing suture just above the pylorus for this purpose. This method of producing obstruction, although temporary, will last long enough to enable

healing to take place. An ulcer so treated will recur but rarely, if recurrence does take place, it will be necessary to make the obstruction permanent either by complete division of the pyloric end of the stomach and turning both sides in—a method developed by Von Eiselsberg—or, more easily but less surely, by drawing a piece of fascia obtained from the sheath of the rectus muscle close about the stomach just above the pylorus and suturing it in such position as to obstruct the lumen, as recommended by Wilms.

Ulcers of the anterior wall of the duodenum may be excised in suitable cases with satisfactory results without performing gastro-enterostomy. The excision of the ulcer should be accompanied by division of the pyloric sphincter, using either the Finney or the Heinecke-Mikulicz method of pyloroplasty in the closure. The gastroduodenal opening should be made at least two and one-half inches in length.

We (W J and C H Mayo) have excised chronic duodenal ulcers in 52 cases in the clinic at St. Mary's Hospital (Dec 31, 1912) without performing gastro-enterostomy, and excellent results both immediate and remote have followed.

The pathologic examination of these ulcers after excision developed some interesting facts. Basing our expectations upon data concerning ulcers removed from the stomach, we were surprised to find that many of the duodenal ulcers involving the anterior wall had few of the physical characteristics of gastric ulcers. A gastric ulcer is a punched-out defect in the mucous membrane with sclerosed grayish-white base surrounded by thickened margins of somewhat overhanging mucosa. Ulcers on the anterior wall of the duodenum with obstruction and callus upon excision will often show a defect scarcely larger than a dimple. This defect may resemble a little split in the mucosa and is sometimes surrounded by an area of thickened congested mucous membrane like a patch set in the duodenum. In several of our cases showing well-marked callus, an ulcer could scarcely be detected but the changed spot of mucosa directly underneath the callus was very prominent. The size of the callus in the submucous,

muscular, and peritoneal coats and the amount of obstruction apparently bear little relation to the actual size of the ulcer, which varies from a mere slit to the size of a pea. Even in the larger ulcers of the anterior wall the base is not often clean-cut and grayish white like gastric ulcer, but resembles more a moth-eaten patch. When the peritoneum is involved the condition of chronic protected perforation develops with adhesions to the liver, gall-bladder, and omenta. The mucous membrane of the duodenum above the common duct is smooth, thin, granular, and has few folds. It may be this anatomical peculiarity which prevents the development of thick ulcers of the gastric type. When the ulcer is of the gastric type, that is, a punched-out defect with a calloused base, a raised corn-like elevation will be found on the peritoneal surface which gives the thickness necessary for the base of the ulcer. In these latter cases there may be a contact ulcer of mucous erosion type on the posterior wall of the eroded mucous type.

So far as we have been able to observe, ulcers of the posterior wall of the duodenum present the same characteristics as those of the stomach, that is, a clean-cut, definitely punched-out area, attached closely to the pancreas and usually completely perforating the duodenum. They are protected posteriorly by a callus which forms the base of the ulcer. In such cases, however, an anterior contact ulcer will usually be found just opposite the lesion on the posterior wall.

We had excised several ulcers of the anterior duodenal wall before our attention was attracted to the occasional co-existence of an ulcer on the posterior wall by a case in which after excising an anterior ulcer, a second was discovered posteriorly which had been concealed by the pyloric ring. The ulcer on the anterior wall was evidently secondary and due to contact. In four instances I excised an ulcer on the posterior wall, suturing the defect from the mucous side. In each case the base of the ulcer was closely attached or fused with the pancreas and, since it was impossible to get at the posterior wall to apply an outer row of sutures, I contented myself in

two cases with a protecting suture at the upper and lower peritoneal angles. In one case a complete division was made of the duodenum after excision of the ulcer with direct union of the end of the duodenum to the end of the stomach. In the fourth case *devitalizing* mattress sutures were applied from the mucous side in such manner as to cut out the ulcer.

The excision of these four posterior ulcers of the duodenum proved to be so difficult as contrasted with gastro-enterostomy that we are not encouraged to continue the practice, although the patients recovered and remain well. I believe, therefore, that the excision of duodenal ulcers should be limited to those occurring on the anterior wall.

The pathologic findings in these ulcers of the anterior duodenal wall have some illuminating features. They demonstrate just why this type of ulcer might be overlooked and probably is overlooked in the average routine examination of the duodenum at autopsy. The findings also explain why the diagnosis of chronic ulcer of the duodenum may not furnish X-ray demonstration. A minute ulcer, unaccompanied by obstruction and without deformity, certainly would not exhibit convincing data. The X-ray has, however, been a valuable means of diagnosis in the cases of gastric ulcers and those ulcers of the duodenum accompanied with obstruction, not because of the actual demonstration of the ulcer, but by the determination of deformities and perverted muscular function.

Our limited experience in the excision of duodenal ulcers does not permit us to state that all ulcers of the anterior wall of the duodenum are of the above type and it may not be true of the thick, calloused obstructive duodenal ulcers. As these latter cases are not suitable for excision, pathologic material has not been available. These observations may be of value in drawing attention to the fact that at least a considerable percentage of ulcers of the anterior wall of the duodenum have different characteristics from those of the stomach, characteristics which have been the cause of much confusion because they failed to conform to the standard of gastric ulcer.

# REMARKS ON FATAL HEMORRHAGE FROM EROSION OF THE GASTRODUODENAL ARTERY BY DUODENAL ULCERS.\*

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It has been my misfortune to have witnessed two fatal cases of bleeding from duodenal ulcers in spite of the operation of gastro-enterostomy. In both cases the ulcer was situated on the posterior surface of the first portion of the duodenum, and in both the hemorrhage, which proved fatal, came on at a time when it looked as if the patients would recover from the operation.

The first patient died 34 hours after the operation with all the symptoms of concealed hemorrhage, but as no autopsy was allowed we can only surmise, from the position of the ulcer, that the gastroduodenal vessel was eroded. For this reason I have appended brief notes only.

CASE I—R A, white, male, aged 28. He had suffered from symptoms of dyspepsia for over three years, characterized by epigastric pain appearing usually about two hours after meals, acid eructations, and the occasional appearance of blood in the stools. During the six months prior to operation he had suffered from several fainting spells, which had been followed by the passage of stools containing much blood. Three weeks before he came under observation an alarming hemorrhage had occurred, from which the patient had not entirely recovered. He was so weak and anæmic that he was confined to bed. Every stool was tarry.

Operation was performed on June 9, 1905. The stomach showed no evidence of ulceration. A thickened, ulcerated area was felt in the posterior wall of the first portion of the duodenum. A posterior gastro-enterostomy was performed. The patient

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rallied from the operation poorly. Early next day he was a little better, but toward evening he became restless and faint. He grew gradually weaker and died at the end of 34 hours with all the symptoms of internal hemorrhage.

CASE II—H N A, aged 35, white, male. In April, 1899, he began to suffer from pains in his stomach, which came and went without apparent connection with eating. They were relieved in a few minutes by bicarbonate of soda. No loss of weight or diarrhœa was noticed. The pains occurred at unequal intervals, and disappeared entirely at the end of two months.

In the fall of 1903 the same symptoms reappeared and were accompanied by vomiting. At first the vomited matter consisted of partially digested food only, but at the end of a month it was frequently dark or coffee-colored. At the end of three months the symptoms disappeared entirely. No notice was taken of the stools. In June, 1910, the pains returned again, and were relieved by bicarbonate of soda. In October of the same year he passed segments of a tapeworm and continued to pass them until November, when a vermifuge removed the worm. About the middle of November the pain reappeared. It was accompanied with gas, and vomiting soon after meals. There was gradual loss of weight. About Christmas the worms reappeared in the stools, and have been present ever since. From this time the stomach symptoms have continued without cessation up to the present. The pain comes on usually within an hour after meals and is intense for two or three hours, when it subsides somewhat. It never entirely disappears, however, and interferes with sleeping so much that he only rests on an average three or four hours each night. There are always intensely acid eructations and frequently vomiting of stomach contents. There has been marked constipation and a loss of weight of 44 pounds during the last four months.

On March 18, while undergoing a physical examination, he was handled rather roughly. On March 19 a test meal was taken, and on account of the failure to pass a stomach tube an injection of gr  $\frac{1}{50}$  of apomorphia was given. About 20 minutes afterward, when the effects of the apomorphia had passed away, while sitting in a chair laughing and talking, he fainted without any warning. The condition appeared to be relieved promptly by the injection of strychnia. In a few hours the bowels

moved and the stool was saturated with blood. The same conditions were noticed on March 20 and 21. On March 22 he came under the care of my colleague, Dr Graves. He was then suffering from the effects of severe hemorrhage. He was very blanched. A blood examination showed red cells 3,760,000, white cells 7800, hæmoglobin 75 per cent. The urine showed nothing abnormal. An examination of the stools showed blood present and segments of *Tænia saginata*. On March 24 a rectal examination was made, but nothing abnormal found. A diagnosis of duodenal ulcer was made and operation suggested, but positively declined.

On March 25, in the afternoon, the patient became faint, was covered with cold sweat, and showed signs of severe internal hemorrhage. I saw him on March 26, and although he had recovered somewhat, his condition was still desperate. During the day he improved somewhat and on March 27 he consented to the operation. At 2.30 P.M. the operation was performed. The stomach was large, flabby, and anæmic. The first part of the duodenum at first appeared healthy, but on palpation a large indurated area was felt occupying its posterior wall and the adjacent part of the pancreas. The coils of jejunum were distended with blood. A gastro-enterostomy was performed, but the duodenum was not folded in.

The patient endured the operation fairly well and was carried to bed in fair condition. After the operation the patient continued to improve steadily. His condition when I saw him late at night on the 28th was excellent. At 7 A.M. on the morning of the 29th he showed signs of a return of the hemorrhage. In half an hour he was almost pulseless, and he died a most tragic death as we were preparing to transfuse him directly from the radial artery of his wife. He lived 42 hours after the operation.

I conducted the post-mortem examination personally within an hour of his death. The stomach, pancreas, and duodenum were removed "en masse". The stomach, duodenum, and the whole length of intestinal canal were full of blood. On slitting up the duodenum an ulcer 17 mm long and 17 mm broad was found occupying its posterior wall. It was situated almost midway between the pyloric ring and the bile papilla. The edges were rolled out and indurated. At the bottom of the ulcer a small aperture was seen (Fig 1). A probe passed into it travelled easily in either direction upward or downward. A search was made for the gastro-

duodenal artery After tedious dissection through dense inflamed tissue it was found A stream of water was passed downward along it and it escaped almost at full bore through the opening in the base of the ulcer A similar stream was forced upward along the right gastro-epiploic artery with the same result

Bleeding from duodenal ulcers may vary to any extent both as to quantity and periodicity It is probable that most duodenal ulcers bleed periodically and that the slighter hemorrhages are overlooked, only the more massive ones being recognized Where careful examinations of the stools are made systematically, occult blood is found in a very large proportion of cases, for it is a matter of daily observation that patients do not recognize coffee-ground vomit and tarry stools as positive signs of hemorrhage Ocular manifestation of bleeding is usually registered as "hæmatemesis" or "melæna," and in taking the history of a patient we have usually to rely on their conception of hemorrhage From a clinical stand-point we may divide the bleeding into two varieties (1) *chronic hemorrhage*, in which the blood is lost slowly, and usually in a moderate quantity, and (2) *acute hemorrhage*, often profuse and so abundant as to endanger the patient's life Either variety of hemorrhage may show periodicity, but the chronic form is more likely to be constant than the acute

*Frequency of Hemorrhage*—It is interesting to note the frequency and variety of bleeding In Moynihan's first series of cases he noticed that 71 patients (38 per cent) gave a history of bleeding at one time or another, of these, 17 had hæmatemesis alone, 24 had melæna alone, and 30 had both hæmatemesis and melæna In his second series of cases (101) hemorrhage occurred in 49 (almost 50 per cent), of these, 9 suffered from hæmatemesis alone, 10 from melæna only, and in 21 both hæmatemesis and melæna had been observed

The figures of the older writers were not based on such close clinical observation, but dealt with severe hemorrhage only Perry and Shaw estimated that 13 per cent of the bleeding cases end fatally

*Source of Hemorrhage*—There is not sufficient evidence either of a clinical or pathological nature to enable us to state accurately the source of hemorrhage even in the cases where bleeding has been a prominent symptom. All of Moynihan's cases recovered, so, of course, no pathological proof is possible. He noticed unusually severe hemorrhage in five cases (Nos 14, 19, 28, 43, 138). In three of them the position of the ulcer is stated as being on the posterior wall, in the remaining two the infiltration of the duodenum by inflammatory products was so massive that its exact position could not be determined. The statement is probably true that ulcers occupying the anterior wall rarely cause severe hemorrhage, whereas those on the posterior surface are extremely likely to erode important vessels such as the hepatic and gastroduodenal arteries. Still it must not be forgotten that in the duodenum, as in the stomach, superficial insignificant ulcers may bleed profusely. Thus Quénu reported a case of extreme anæmia due to hæmatemesis, where at operation a small ulcer was found occupying the anterior wall of the first part of the duodenum. Bleeding ceased after obliteration of the pylorus followed by gastro-enterostomy. Also Moynihan reports a case (No 114) where operation was performed on a patient who had suffered from a severe hemorrhage followed by profuse melæna, in which he excised a small round ulcer on the anterior wall of the duodenum, and sutured a precisely similar ulcer on the posterior wall. In the cases collected by Collin, where the source of the fatal hemorrhage was determined by a post-mortem examination, the blood-vessels eroded were as follows.

Arteria pancreaticoduodenalis	12 times
Arteria gastro-epiploica dextra	2 times
Arteria pancreaticoduodenalis superior	3 times
Arteria abdominalis	2 times
Vena portæ . . . . .	2 times
Arteria hepatica	1 time
Arteria mesenterica superior . . . . .	1 time

It would appear, then, that the gastroduodenal artery is more likely to be opened than any other vessel, and thus we should expect from the anatomical relationship of this vessel to the first part of the duodenum. Deep eroding ulcers occupying the posterior wall are sure to extend to this vessel sooner or later, and if thrombosis fails to precede the erosion, severe hemorrhage is inevitable.

*Treatment*—It is proven beyond doubt that in the majority of cases of duodenal ulcer associated with hemorrhage, gastro-enterostomy will check the bleeding. This is shown conclusively in Moynihan's series of cases of severe hemorrhage, 18 in number, where the operation was unattended by any mortality. Of course, there is no definite proof that such a large vessel as the gastroduodenal artery was bleeding in any of his cases, but the severe symptoms in three of them where the ulcer occupied the posterior wall (Nos. 14, 28, 138) point strongly to such a condition. I have found one clinical observation noticed by Mayo Robson that proves conclusively that the rest imposed on the duodenum following an anastomosis favors closure of the artery by a clot. A patient upon whom a gastro-enterostomy had been performed for bleeding supposed to be from a gastric ulcer died at the end of ten days from perforation at the site of anastomosis. The post-mortem examination revealed no evidence of a gastric ulcer, but a large deep duodenal ulcer, at the bottom of which lay the gastroduodenal artery with an ulcerated hole in its side completely closed by a firm thrombus.

The essential principle involved in this method of treatment lies in the enforced rest of the duodenum, which favors clotting at the bleeding points. It is common knowledge that better results follow the operation of anastomosis in cases where the pyloric orifice is obstructed than in those where it is free, and that equally good results can be obtained in the latter cases if the pyloric orifice is obstructed by infolding or is obliterated. Therefore it would be rational in these cases to obliterate, temporarily at least, the pyloric orifice by massive infolding, so as to prevent any particle of food or fluids

passing along the duodenum. In addition to this, infolding of the ulcer is practised if it is situated on the anterior wall, or in case of severe hemorrhage the ulcer might be excised or surrounded with a deep purse-string suture before infolding it. In ulcers of the posterior wall, infolding of the ulcer is not practicable, but it would be feasible to infold the anterior wall so completely that it would form a plug capable of closing the ulcer and blocking up the bleeding vessel mechanically.

I am afraid that in my two cases I allowed the patients to slip through my fingers by trusting too much in the value of gastro-enterostomy alone. It is possible that massive infolding might have prevented a repetition of the bleeding.

Of course direct attack of the bleeding point with suture of the vessel would be the most scientific procedure, but it is more than doubtful if it could be done safely. The situation of the ulcer, its depth, immobility, and the dangers of hemorrhage, all would render such an operation unusually hazardous. Personally I was glad enough to get my patients off the table alive after the anastomosis had been completed.

In a letter recently received from Sir Berkeley Moynihan, he outlined the plan of treatment that has been so uniformly successful in his hands.

"I have found that the gastroduodenal artery is rather apt to be opened if the ulcer occupies any portion of the posterior surface, and especially when the ulcer occupies the upper border and posterior surface. I have two ways of meeting the difficulty. If the artery is seen running into the ulcer, I pass a needle underneath it, and ligature it, and, secondly, close down the anterior wall of the duodenum by infolding sutures on to the ulcer, and make sure of closing the pylorus or the stomach on the near side of the ulcer. In either case, of course, gastro-enterostomy is done. I feel quite sure that in all cases of duodenal ulcer local treatment is necessary in addition to gastro-enterostomy, for many cases of hemorrhage, after an apparently successful gastro-enterostomy, have been recorded."

My interpretation of this letter is that no attempt is made

to open the duodenum but that all the work is accomplished from the outside as outlined Referring to the possibility of passing a ligature under the gastroduodenal artery before it reaches the ulcer, a careful dissection of our specimen showed that it would hardly have been possible Both the hepatic artery and its gastroduodenal branch were embedded in inflamed tissue of such cartilaginous density that the vessel was dissected post mortem with the greatest difficulty

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# ACUTE PERFORATED DUODENAL AND GASTRIC ULCERS.\*

REPORT OF 25 CASES OCCURRING AT THE GERMAN HOSPITAL IN THE LAST  
SIX YEARS

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TWENTY-FIVE cases of acute perforation of chronic duodenal and gastric ulcers have come under our observation during the past six years. We include in this report only those cases in which the peritoneal cavity was suddenly brought into free communication with the interior of either viscus through a perforative opening in the base of a chronic ulcer. The condition of acute perforation therefore presupposes the absence of antecedent peritonitis tending to limit the area of peritoneal involvement. In the event of acute perforation of a chronic calloused ulcer, whether duodenal in situation or one involving the anterior wall of the pyloric antrum, the symptom-complex is exactly the same. Perforated duodenal ulcer, however, more often gives the typical picture because the ulcer-bearing area of this viscus is more difficult of isolation from the general peritoneal cavity, than are the walls of the stomach. Reactive perigastritis involving the parietal peritoneum and the serosa of adjacent viscera usually prevents acute perforation of ulcers situated on the posterior walls of the stomach. That this rule is not invariable is demonstrated by a remarkable case in the author's experience, which was the subject of two acute perforations of the duodenum and an acute perforation of the posterior wall of the stomach. This patient was operated after each perforation, with ultimate recovery. Rupture of either viscus resulting from chronic ulceration may be the cause of sudden death, as Moynihan has shown

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\* Read before the Academy of Surgery, Philadelphia, January 6, 1913



We have never met with this condition, but it has been our experience that patients with ruptured ulcers show varying degrees of shock, or if sufficient time has elapsed since the occurrence of actual perforation, present the picture of toxæmia from peritoneal sepsis. Shock is a symptom of the very early stages of this disease and has been noted in 50 per cent. of our operative cases. Its presence is not essential to the diagnosis, but we cannot agree with Mitchell as to its "mythical" nature.

*Symptoms of Acute Perforation*—A patient, writhing in the agony of peritoneal trauma from intestinal contents propelled through a perforative opening of a chronic duodenal or gastric ulcer, once seen is rarely forgotten.

The differential diagnosis between perforative ulcer of the proximal duodenum and the pyloric end of the stomach is usually impossible, except that the former is much more common than the latter, but that a perforative lesion involving an upper abdominal viscus is present is usually evident to one familiar with its characteristic signs. The attending physician has discharged his obligations in the case when he recognizes the necessity of, and advises immediate operation. These patients are often brought to the hospital by relatives or friends, frightened by the obvious seriousness of the patient's condition. From them we learn of the patient's years of suffering, or intermittent indigestion perhaps, with a recent recurrence, lasting several weeks and terminating in the present attack. The sufferings of the patient and irresponsibility of his associates, preclude accurate history taking. The time for the anamnesis is past. To obtain further details of the case, have the various physicians who have had the patient in charge consult the records on their files of cases of gastric neuroses. Under the caption, Gastralgia or Hyperchlorhydria, the duodenal history of the patient will usually be found. Perhaps the patient has been in good health for some time when, after an unusual physical effort, a heavy meal, or in the entire absence of such predisposing causes, he has been sud-

denly taken with a most agonizing pain in the pit of the stomach. The initial pain in cases of duodenal perforation is often more intense to the right of the midline but finally becomes generalized and more severe in the lower right abdominal quadrant. Morphine has been administered with little or no relief. The parietal and diaphragmatic contractions with retching and vomiting cause painful paroxysms of indescribable intensity, with periods of comparative ease, when the patient begs for operative or other relief. The vomitus is slight in quantity and rarely contains blood. If the perforation has occurred recently, within six hours, examination shows the patient in varying degrees of shock. Although loathe to move, he is expending his slight reserve force in attempting to obtain postural relief. The pupils are dilated, skin cold, clammy and cyanotic, temperature normal or subnormal, the pulse little increased in rapidity but of small volume. The respiratory movements are rapid, shallow and entirely thoracic in type. The body is doubled up and the patient gently applies his hand to the upper abdomen where he complains of exquisite tenderness. The abdomen is scaphoid and so tense are the parietal muscles that the lineæ transversæ and semilunares are seen as depressions between the tense muscle bundles. We have noted a transverse constriction of the abdomen above the umbilicus as if nature were attempting to isolate the inflamed area. Palpation confirms the apparent tenseness of the abdominal muscles. Indeed, in no condition is such rigidity found and one could fairly jump on the recti muscles without creating an impression. The condition is general, but careful examination will usually reveal an area of more obdurate rigidity of the upper right rectus muscle in duodenal cases, of the left rectus in gastric perforation. Under anæsthesia, the rigidity overlying the affected area is last to disappear. The tenderness is general and severe, but here again careful search will reveal an area of exquisite intensity overlying the ulcer. Liver dullness may be obliterated in the presence of scaphoid belly with comparative

tively small volumes of gas escaping through the perforative opening. This is entirely different from the obliteration that comes with the distention of paralytic ileus in the late stages of the condition, the distention of general peritonitis. The most characteristic sign of perforated duodenal or gastric ulcer is the peculiar density of the abdominal walls. To repeat, there is invariably an area, usually overlying the site of perforation, that shows board-like rigidity. This is found typically in the early stages, but continues even after tympanites has set in, nor does it abate until impending death removes the conscious perception of the peritoneal injury. Peristaltic sounds are almost invariably absent.

Lennander has shown that the maximum sensitiveness of the peritoneum is found in the perihepatic and diaphragmatic regions, and especially in the area adjacent to the foramen of Winslow. Herein we find an anatomic explanation for the peculiarly severe pain experienced in ruptured ulcer. The sensory nerve supply of both the thoracic and abdominal surfaces of the central portion of the diaphragm is derived from the phrenic nerve. Diaphragmatic spasm is the expression of irritation of the sensory fibres of the phrenic nerve on the abdominal side of this muscle. It is reasonable to suppose that this explains in large measure the respiratory symptoms and shock present. Intra-peritoneal rupture of any hollow abdominal viscus is followed by shock, but as a rule of less severity than that associated with perforative lesions of the upper abdominal organs. In the case of the duodenum and stomach, the irritative character of the acid contents of these viscera in part explains the degree of shock, with the great richness in sensory nerve supply of the upper abdominal peritoneum as the underlying cause. It is evident that the state of digestive activity at the moment of perforation determines the chemic reaction of duodenal and gastric contents. This also determines, in conjunction with the peristaltic activity, and size of the perforative opening, the volume of fluid pro-  
against the sensitive serosa. As we have said, it is

hard plaques of calcium The contents consisted of three litres of thick brownish-yellow fluid, leucocytes, much albumin, cholesterol crystals, red blood-cells in various stages of degeneration Twelve years after operation the patient was still in good health

ROUTIER (1901) Female, aged 24 In 1892 pain in the region of the spleen followed by tumor the size of a fist The tumor extended two fingers' breadth beyond the median line to the right Freely movable, no malaria Pregnancy and normal labor in 1900 Tumor rapidly increased in size Splenectomy in 1901 Recovery Splenic tumor occupied the lower half of the organ, upper half normal Multiple organized hæmatomas

ROYSTER, H (1) Female, aged 24 Chills and indigestion Tumor of the abdomen gradually increasing in size Operation, splenectomy Spleen adherent to omentum which also contained two cysts Recovery Pathologic report Spleen nearly normal in size and shape Thin-walled cyst growing from the lower pole containing one pint of clear watery fluid Serous, non-parasitic cyst Wall of cyst consisted of spleen tissue (2) Male, aged 22 Occupation, mill operator Occasion to press sternum and lower chest against frame run by machinery Pain in the left upper abdomen Chills, swelling of the abdomen, gradual growth Operation, splenectomy Dark liquid contained within thin walls Upon insertion of trochar cyst collapsed Four quarts of bloody fluid obtained Pathologic report Blood cyst arose from the inner surface of the organ Spleen enlarged, weighed nine ounces Wall of cyst contained splenic tissue

SCHALITA (1895) Female, aged 36 October, 1893 For the past five months enlargement of the left hypochondrium, accompanied with lumbago-like pains and swelling of the legs Movable, elastic, partly fluctuating ovoid tumor Smooth and painless lying diagonally and extending to the right No hydatid murmur No ascites Operation Median incision The anterior aspect of the growth was a dark cinnamon color adherent to the omentum, where veins were enlarged and prominent about thickness of the finger A trochar was inserted and cyst emptied of eight litres of coffee-colored fluid Pedicle and extensive adhesions ligated and cut Recovery The growth originated from the lower pole of the spleen, was the size of a man's head Growth presented a smooth thick covering continuous with the splenic capsule The interior resembled the laminated layers of the inner surface of an aneurism Spleen weighed 3500 Grams, cyst originated from the lower pole, upper pole normal

SUBBOTIC. (1) Malarial splenomegaly, perisplenitis, floating spleen Splenectomy Female, aged 40 Multipara Upon the surface of the thickened and cloudy serosa, on the convex side and edge of the spleen, several fringe-like growths were found, some as large as 5 cm Some of these were puffed up and filled with serous fluid In addition, on the convex surface were found two cysts the size of beans, subserous, flat, with bloody contents (2) Splenomegaly, lymphatic cyst at the hilum Female, aged 30 At the centre of the hilum and a little behind the

and absent in the upper abdomen. The liver dulness was normal.

At operation, an hour after admission, on opening the peritoneum, gas escaped with the characteristic sound, together with small amounts of yellow fluid. A chronic calloused ulcer was found involving the upper anterior wall of the first portion of the duodenum. In the centre of this was a perforative opening the size of a goose quill. The surrounding peritoneum showed the signs of beginning inflammation. Closure of the perforation, duodenal plication, and posterior gastro-entrostomy were performed, glass tube drainage placed in the pelvis and the patient placed on the Murphy-Ochsner treatment. His recovery was speedy and complete.

It must not be supposed that every case presents the same clear cut clinical picture. At times it is extremely difficult or even impossible to differentiate the various acute abdominal lesions. Without discussing the subject of differential diagnosis at length, we would draw attention to the fact that acute perforation of the base of the appendix will in a percentage of cases be attended by rigidity of the overlying abdominal walls equally as marked as in perforated ulcer. Later, however, in the course of the disease, this rigidity is less marked in the upper abdomen. Again, after a lapse of twelve hours when the extravasated fluid from the perforated ulcer will have gravitated to the right iliac fossa, following the peritoneal gutters (paracolic grooves) to either side of the ascending colon, the diagnosis is obscure. I have been unable to make the distinction on a few occasions until the abdomen was opened. We then have the added picture of right iliac peritonitis, and in the absence of suggestive history, typical upper abdominal findings or both, the diagnosis is impossible. Contrast the foregoing typical signs with the following atypical case.

J. A., male, aged thirty-three years, was admitted to the hospital June 5, 1911, complaining of severe general abdominal pain and vomiting. For the past eight years, the patient has had intermittent attacks of abdominal pain, appearing several hours

often impossible to differentially diagnose a perforated duodenal ulcer and one situated on the anterior wall of the pyloric antrum, and especially is this true in the absence of a typical preperforative history. In the presence of the typical history, however, the ease of diagnosis of a perforative lesion of one or the other of these viscera is proportionate with the difficulty of differential diagnosis. The following case demonstrates the ease of diagnosis in the presence of a complete history and typical physical signs.

A W, male, aged thirty-two years, a machinist, was brought to the German Hospital at 2 30 on the morning of May 25, 1910, by a fellow workman. He had suffered with chronic indigestion for a period of five years, and had been treated intermittently. The time of occurrence of this pain, its relief by eating and other symptoms were characteristic of duodenal ulcer of the chronic type. The patient had been unusually well for some time. At 12 30 on the morning of admission he had eaten his luncheon, consisting of fruit, sandwiches and coffee, and returned to his work feeling perfectly well. In half an hour he was seized with the most excruciating upper abdominal pain, paroxysmal in type, beginning in the pit of the stomach and referred all over the abdomen and into the back and chest. This pain was associated with nausea, retching and belching of gas. The house surgeon found the patient lying on his right side, his body doubled up and loathe to move lest his suffering should be increased. Frequent belching increased the pain and the patient made ineffectual efforts to suppress it. The face was pinched and wore an anxious expression. The extremities were cyanotic, and like the body surface cold and clammy. The respiratory movements were rapid, shallow and entirely thoracic in type. Temperature 97°, pulse 110, respiration 30, leucocytes 50, polymorphonuclears 76 per cent. Examination of the abdomen showed a "scaphoid belly" with generalized rigidity. This was especially marked in the upper right quadrant. The upper right rectus muscle was board-like in rigidity. Over this area there was exquisite tenderness, with marked tenderness of the remaining portions of the abdomen. Peristalsis was faintly heard in the lower abdomen,

tonitis, in which death followed simple closure of the perforation. It has been our experience that recently ruptured ulcers of the duodenum and stomach bear surgery very well. With the onset of peritonitis, the prognosis of course becomes that of this complication, made worse by the almost absolute necessity of operative closure of the perforative opening and without the probability of localization of the disease. After the lapse of 24 hours, the prognosis of ruptured ulcer is usually hopeless, but unless moribund, this type of patient should have the benefit of immediate operation with rapid closure of the perforation and institution of pelvic drainage. We advocate and practice complete operation in all recent cases. There are a few border line cases in which this rule must be put aside for simpler incomplete though life saving measures, reserving the curative technic for a future operation. The presence of shock should not deter the surgeon from resort to immediate operation.

In ulcers of the duodenum, the perforation is closed with a purse-string suture of linen, the ulcer bearing area infolded and the duodenum plicated, if possible, proximal to the ulcer. The operation is completed with a posterior gastro-enterostomy. Mere closure of a perforation in the centre of a chronic calloused ulcer is life saving but does not cure the ulcer. It is true that after simple closure, these patients are usually clinically well in the immediate post-operative period, but this subsidence of symptoms is by no means invariable and its occurrence characteristic of ulcer, and gives no assurance that the diseased process is arrested. Obstruction, a second perforation, erosion of large arteries or crippling adhesions may take the life of the patient or necessitate a future operation.

Infolding of a duodenal ulcer if complete is usually impossible without serious obstruction to the viscus, therefore gastro-enterostomy is essential.

Complete isolation of the ulcer bearing area by plication with posterior gastrojejunostomy is the rational surgery of chronic ulceration of the duodenum. The surgeon incapable of the rapid application of the latter procedure should not attempt the operative treatment of perforated ulcers of the

after meals and relieved by eating. During the past three months this pain has shifted its position to the right lower abdominal quadrant and has been of daily occurrence. He has never vomited blood nor noticed blood in the stools. The present attack began 24 hours before admission with sudden severe pain in the lower right abdominal quadrant. This has been unremitting and associated with vomiting. The abdomen became very tense and tender soon after the pain began. Examination showed general distention, rigidity and tenderness, more marked over the gall-bladder and appendix regions. Temperature  $100^{\circ}$ , pulse 112, respirations 36, leucocytes 13,150, polymorphonuclears 93.5 per cent. The serosa of the appendix was inflamed but the cause of the peritonitis found in the stomach. A perforated ulcer was found on the anterior wall of the pyloric antrum, 1 cm. distant from the pyloric vein. Owing to a very slight degree of induration surrounding the ulcer, the involved area was not excised. This patient has remained well after the usual plication of the duodenum and posterior gastro-enterostomy.

To mistake the origin of a peritonitis in suspecting the appendix as the primary source of infection is not a serious matter, as the operative findings will usually lead to investigation of the upper abdominal quadrant. This is perhaps not true of cases far advanced in peritonitis, but in these late cases treatment as a rule is futile.

*Treatment*—During the past six years, 25 cases of acute rupture of ulcers involving the upper intestinal tract have been admitted to our hospital service. In 21 of these cases the ulcer involved the proximal duodenum, in 3 cases the anterior wall of the pyloric antrum and in 1 case the proximal jejunum. Of these cases, 6 were admitted after the lapse of 24 hours or more from the time of actual perforation, practically moribund, and all died without operation.

One of the late cases occurred in a man eighty-two years of age and is of interest on account of the post-mortem finding of a typical benign chronic ulcer of the duodenum at this extreme old age. Of the 19 operated cases, all were subjected to the complete operation with two exceptions and all recovered except one, a very late case, with diffuse purulent peri-



deep cyanosis disappeared with active stimulation and saline transfusion. An hour later he was given sub-arachnoid stovaine anaesthesia. The patient immediately developed alarming signs of cardiac and respiratory failure, and was taken out of the operating room practically moribund. He was placed in the Trendelenburg position, given artificial respiration, active stimulation and a second saline transfusion. He was operated on a half hour later without further anaesthesia, and a large duodenal perforation closed. The abdomen was filled with black mucoid material and pus, a large quantity of which drained from the pelvis. The improvement was gradual for several days when signs of right-sided pleural effusion appeared. Purulent material was first aspirated from the right pleural cavity, and later a portion of the eighth rib on the right side removed from the mid-axillary region under nitrous oxide gas anaesthesia. One month later he was discharged in good condition. At our request, the patient returned in September of the present year and reported perfect health since the last operation. We plicated the duodenum and performed a posterior gastrojejunostomy and have discharged this remarkable case cured—not merely relieved.

The criterion of value of any method of treatment is the result obtained by its application. The combined statistics of many leaders in upper abdominal surgery show not only a smaller primary mortality with the complete operation in acute perforation of gastric and duodenal ulcers, but a smaller post-operative morbidity. We have lost only one patient, a late case with simple closure of the perforation. Seventeen cases with primary, and one case with secondary gastrojejunostomy recovered and were discharged from the hospital in good health. This result is sufficient argument and justification for our faith in primary gastrojejunostomy. By its application we conduct our patients to a speedy, safe and complete cure with the least jeopardy to their future health.

Since reading this paper I have had six cases of acute perforated duodenal ulcer to record, in which I closed the perforation and did a posterior gastro-enterostomy. Each patient made an uneventful recovery. Making 25 operative cases with one death.

# RESECTION OF ONE-THIRD OF THE COLON FOR IRREDUCIBLE INTUSSUSCEPTION IN AN INFANT FIVE DAYS OLD.

BY CHARLES N. DOWD, M.D.,

OF NEW YORK

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THIS infant presented to the New York Surgical Society, January 22, 1913, was born on Monday, December 30, 1912, and appeared normal until the following Friday morning at 2 o'clock. He had taken some breast milk and had retained it in the ordinary way, and had had normal bowel movements. At that time he began to cry and seemed in much pain, he also vomited, the crying continued with more or less severity for about two hours, he then became quiet and remained quiet during the forenoon. At four o'clock on the afternoon of the same day he had a bloody stool. The physician, Dr. Anton H. Martin, saw him about four hours later and made the diagnosis of intussusception. At that time the intussusceptum could be felt through the rectum and a mass could be felt in the abdomen. He advised taking the infant to St. Mary's Hospital for Children. The parents, however, did not take the child to the hospital until the afternoon of the following day. The persistence of the crying, the vomiting, and the bloody discharges on the diapers at last led them to follow the advice which their physician had given on the previous day. At this time the child was not a promising subject for operation, he weighed  $6\frac{1}{2}$  pounds and was thin and prostrated. He had vomited much "green phlegm." Blood came from the rectum when examination was made there, the intussusceptum could be felt close to the anus and could not be reduced. A mass could be felt in the left side of the abdomen.

The operation, which was done without delay, began 37 hours after the onset of the symptoms. After a long incision had been made through the right rectus the intussusceptum could be pushed up until its apex was a little above the sigmoid flexure. It was impossible to push it further than this, and, although very careful efforts were made, the coating of the bowel began to split.

several places and the effort had to be abandoned. During this time the child lay on the table in a condition of profound prostration. Dr Farr, who was giving ether as an anæsthetic, said that he could hardly be sure he was alive excepting for the fact that the pupils did not dilate, the pulse could not be felt, and respiration consisted of nothing more than an occasional shallow gasp. It was evident that the only possibility of saving the child's life was in resecting the intussuscepted portion of the intestine. This was therefore done. The intestine was removed from above the middle of the transverse colon to the upper portion of the sigmoid colon, and its mesenteric vessels tied. Both ends of the remaining intestine were invaginated by the aid of purse-string sutures, a lateral anastomosis was quickly made without clamps, silk being used for the outer line of stitches and chromic gut for the inner line, which included all the intestinal layers. The abdominal wound was closed, a hypodermoclysis was given in each axilla, and the child was returned to the ward in a condition rather better than that which he had shown at the earlier part of the operation. The healing of the anastomosis occurred without incident, and the child had slight bowel movement on the first day, and on the second day passed reasonably good stools. He took his nourishment in small amounts but without particular difficulty. The mother was brought to the hospital so that breast milk could be used, but the child would not take it, he is, however, progressing satisfactorily on an artificial milk mixture and is steadily gaining in strength. The abdominal incision is healing satisfactorily, although more slowly than in ordinary cases.

*Record of Intestinal Resection in Infants*.—The operation of intestinal resection for intussusception in little children has had a very high mortality rate. In Clubbe's<sup>1</sup> Australian series of 127 intussusceptions there were eight intestinal resections with only one recovery, that in a child of eleven months. In Eccles's<sup>2</sup> St Bartholomew Hospital report of 89 cases, there were nine resections with no recoveries. Makins<sup>3</sup> reports

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\* While this article is in press, the following reference has been found. Hughes, Gerald S (Lancet, Sept 23, 1912, page 379) reports a successful end-to-end anastomosis after a resection of 15 inches of the intestine for ileocolic intussusception in a child of six months.

from St Thomas Hospital records of 12 resections with immediate union among 202 intussusceptions, only two of these 12 cases recovered and they were both adults Koch and Oerum,<sup>4</sup> reporting 400 Danish cases in children, recorded eight resections with no recoveries

Curiously enough Continental observers<sup>5, 6</sup> record intussusception in little children in much smaller proportion than do writers from England, America, and Australia, hence their statistics refer to older patients, 30 8/10 years was the average age in Von Eiselsberg's series of 13 resections for intussusception

Doctor Charles E Farr has searched the literature for cases less than a year of age who have recovered after intestinal resection for intussusception and has found the following records. Peterson,<sup>7</sup> an infant age  $4\frac{2}{3}$  months, Collinson,<sup>8</sup> an infant age 3 months, Flint,<sup>9</sup> an infant age 11 months, Woolfenden,<sup>10</sup> an infant age 3 months, Fairbanks and Vickers,<sup>11</sup> an infant age 7 months, Hughes,<sup>12</sup> an infant of 6 months

None of the cases were as young as the case here recorded Probably other cases less than a year old could be added, but the fact that a fairly thorough search has revealed only six cases is an indication of the rarity of such recovery These cases, however, are enough to show that intestinal resection will occasionally save the life of one of these little babies when the intussusception is irreducible The fact that a five-day old infant can endure the ordeal is surely an encouragement to persist with the operation even in most desperate cases

*Symptomatology*—It may be noted that this patient had the five classical symptoms (1) a sudden attack of pain accompanied by crying, (2) vomiting which could not be controlled, (3) blood from the rectum, which came in this instance 12 hours after the onset of pain, (4) palpable mass within the rectum, (5) mass palpable by external abdominal examination

Of these five symptoms blood from the rectum is probably the one which aids most in diagnosis The crying and the

vomiting are valuable aids, particularly if they conform to Clubbe's description of a sudden attack in a child previously well "The scream followed by the pallor, sometimes described as 'fainting' or 'stiffening' out, then the subsequent vomiting and straining, fits of crying from time to time, intervals when the child seemed all right" Yet babies cry often and have attacks of vomiting, and such attacks do not often indicate a serious disorder. Blood on the diaper, however, should be looked at as a danger signal and should lead to very careful search for other symptoms. Among Eccles's cases blood or bloody mucus was present in 61, absent in 3, not noted in 6. This corresponds fairly well to the reports of other observers. The diagnosis is not often made without this symptom.

Naturally if the diagnosis of intussusception is once suggested one would feel for the mass. Clubbe states that he can only remember two cases in which he opened the abdomen without first feeling the mass. He regularly gives an anæsthetic if he cannot make a satisfactory examination without it. One must, however, remember that 90 per cent of his patients were less than a year old, and that bimanual examination is more satisfactory in babies than in older children. The apex of the intussusceptum should always be felt for within the rectum. It was felt in 19 per cent of Eccles's cases.

*Method of Operation*—Resection of the intestine is only to be undertaken when other measures have failed. An effort to reduce the intussusception by irrigation is still advocated by many writers—such effort would have added danger instead of diminishing danger in the patients whom the writer has seen. If the abdomen is opened the effort to reduce the intussusception should be made with the utmost patience and care. By pressing from below the apex of the intussusceptum can be pushed upward and the intestine will gradually unfold in about 90 per cent of the cases. Even if cracks occur in the peritoneum, the pressure and manipulation should be continued, peritoneal cracks can easily be repaired by stitches if the intussusception is once relieved.

In the few cases in whom reduction is impossible resection is the best recourse. If a resection must be done in babies, a two-stage operation is to be avoided when possible. Four of the above mentioned successful operators used buttons either of the Murphy or Mayo Robson type. The fifth (Woolfenden) used Paul's tubes and did a two-stage operation. The sixth did an end-to-end anastomosis with needle and thread. In the writer's case the involved part of the intestine was very oedematous, possibly gangrenous in spots, and it was much lacerated by the efforts at reduction. Its immediate removal was imperative. This left the cut ends of the colon held in clamps and well out of the wound. It was easier to invert these ends by purse-string stitches and do a lateral anastomosis than to follow any other technic. Clamps were not needed, unless possibly a very delicate clamp, applied transversely, might have prevented leakage from above better than finger pressure did. The present tendency is toward use of sutures rather than buttons or bobbins, and babies' intestines surely seem well adapted to such use.

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# COMPLICATIONS FOLLOWING SURGICAL OPERATIONS

A REPORT OF THE COMPLICATIONS AND DEATHS IN A SERIES OF 5835 SURGICAL OPERATIONS PERFORMED IN THE MAYO CLINIC, ST. MARY'S HOSPITAL, IN THE YEAR 1912

BY E H BECKMAN, M.D.,  
OF ROCHESTER, MINN.

A PERFECT restoration to health with an uninterrupted convalescence is the end sought in every surgical case. When this convalescence is delayed by a complication, however slight, the result must be regarded as a failure to obtain that ideal for which all surgeons are working. For the past three years an accurate record has been kept of all complications occurring in the Mayo Clinic. This work was begun in order to determine the number of failures occurring in our work and was undertaken primarily for the benefit of our own staff.

We publish these complications for the first time, realizing that failures are the stepping stones on which real progress is founded. We hope to make a report of this kind each year and trust that it will be of benefit to others engaged in surgical work and that other clinics, following this lead, will make similar reports instead of the brief reports of recoveries and deaths which is customary at the present time.

The 5835 cases here reported are the house patients (in-patients) and do not include the patients having minor operations (out-patients) of whom there were 1218. Therefore, these patients were the more serious type of cases whose operations were considered grave enough to require them to remain in the hospital for treatment.

*Infections*—Infections following surgical operations may be regarded in two ways.

First, all patients may be considered as infected before any operation is performed and when suppuration occurs the surgical technic employed has failed to overcome the infection.

In this theory (which is the correct one) the normal resistance of the individual tissues to pathogenic bacteria must be taken into consideration. It should be remembered that under normal conditions the tissues have a certain resistance against bacterial invasion, but when that resistance is lowered (for example, by prolonged sickness, a severe surgical operation or long continued absorption from a neoplasm) the normal bactericidal properties of the tissues are interfered with so that the bacteria flourish and we say that the patient has an infection. An operative technic should be attempted which will interfere as little as possible with the normal functions of the tissues so that their vitality, or, in other words, their resistance to pathogenic bacteria is lowered as little as possible.

Second, many surgeons apparently regard the tissues of the body as being sterile, and when an infection occurs following a surgical operation they at once assume that the offending organism has been introduced from some extraneous source. It must be remembered that pathogenic bacteria may be in the tissues or introduced from some outside source or both, and it is only occasionally that the source of the infecting organism can be found.

For several years every infection occurring in St. Mary's Hospital has been reported to the pathologic department and an endeavor made to trace the source of the infection, but seldom has any definite conclusion been reached. An infection has never been traced to the suture material used. In the following series of cases every wound which failed to heal by primary union was considered as an infection. Many of such discharged only a few drops of serum. A considerable number of such cases showed no growth in the cultures taken from the discharge from the wound. It has not been possible to take cultures for bacteria in all cases operated on the past year, but we hope to give a complete bacteriological report on all such cases in the future. Fortunately there were no deaths the past year from wound infection.



The following table gives the number of infections in each class of operation, a total of 111 or a percentage of 0.19 per cent. for the 5835 patients.

	No Operations	No Infections
Appendectomy . . . . .	977	32
Operations on tubes and ovaries . . . . .	229	1*
Block dissection neck . . . . .	41	1
Cæsarean section . . . . .	6	1
Diverticulitis sigmoid . . . . .	1	1
Excision ulcer stomach . . . . .	20	1*
Excision angioma neck . . . . .	1	1
Gastro-enterostomy (ant and post) . . . . .	274	17
Halsted amputation breast . . . . .	101	4
Hernia (inguinal) . . . . .	315	14*
Hernia (umbilical) . . . . .	30	1
Hernia (ventral) . . . . .	78	1
Hysterectomy (subtotal abd) . . . . .	215	2
Hysterectomy (total abdominal) . . . . .	38	3
Kocher operation, uterine prolapse . . . . .	39	2
Ligation superior thyroid arteries . . . . .	363	7
Meckel's diverticulum . . . . .	8	1*
Pyloroplasty . . . . .	20	2
Resection stomach . . . . .	46	2
Spina bifida . . . . .	3	1
Suture spinal accessory and facial nerves . . . . .	1	1
Sarcoma thigh and inguinal glands . . . . .	1	1
Shortening round ligaments (retroversion), 41 ext, 119 int. . . . .	160	2
Thyroidectomy . . . . .	875	8
Varicose veins . . . . .	47	4

\*One of these had the appendix removed also

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It will be seen that there are a considerable number of infections in appendectomies. When we made small McBurney incisions we rarely saw an infection. Now we make long straight incisions in a large number of cases and explore the entire abdomen in nearly every case regardless of the incision. When a McBurney incision is made the hand is also nearly always introduced to explore the abdomen. We have thought that the introduction of the hand through a small incision which, of necessity, draws the skin edges forcibly into the deeper layers of the wound was a large factor in this increase

of infection and we are taking added precautions against such contamination. The value to the patient of having a thorough abdominal exploration whenever the abdomen is entered has more than offset the slight infections that have possibly originated from this procedure

The escape of secretions from the stomach and intestines is another source of infection in operations on those parts of the alimentary canal. Nearly one-sixth of the total infections occurred following operations on these organs

*Pulmonary Complications*—Three cases showed symptoms of pulmonary embolism. There is a possibility of a mistaken diagnosis in these cases. In each instance there was sudden pain in the chest accompanied by dyspnoea, a rapid pulse, and pallor, followed in a few days by a cough, with which the patient expectorated blood-streaked material. These symptoms would indicate an infarct in the lung with softening later in the area of the infarct. These emboli occurred in patients as follows: (1) A patient on whom a cholecystectomy had been done and who also had a shortening of the round ligaments. (2) A patient with varicose veins in whom an inguinal hernia had been repaired. (3) A patient whose common bile duct had been drained.

The pulmonary complications have been classified into four groups.

*Group I Pleurisy*—Patients who have a pain in the chest with a slight rise in temperature or no fever and a slight cough. There is often no cough. Hot applications or strapping of the side usually relieve the patient. The symptoms as a rule last only a few days, rarely longer than one week. We believe that in patients operated on for conditions in the upper abdomen the pleurisy often is a result of the post-operative inflammatory reaction extending to the diaphragm and pleura.

*Group II Bronchitis*—Under this heading are placed those cases which have an excessive secretion in the air passages. Many of them have only a slight rise in tempera-

ture for a few days and expectorate excessive amounts of mucus or muco-purulent material. Others have a temperature of  $102^{\circ}$  to  $103^{\circ}$  F with increased respiration, but the symptoms quickly subside and the temperature drops to normal in 48 to 72 hours. The physical examination discloses no areas of consolidation in the lungs. Some of these cases appear to be a congestion of the lungs or more properly a congestion of the mucous membrane of the air passages. An upright position, fresh air and heat applied to keep the skin active are usually sufficient to bring speedy relief. Atropine is sometimes of marked benefit and is about the only medication used.

Group III *Bronchopneumonia*—In this group are the cases in which the inflammation has seemed to extend from the air passages into the tissues of the lung. The physical examination shows areas of consolidation or congestion in the lungs. The convalescence in these patients is slower than of those in Group II. The temperature is irregular and varies from normal to  $102^{\circ}$  F.

Group IV. *Lobar Pneumonia*—In this group are those patients who have a definite consolidation of the lung with a temperature of  $102^{\circ}$  to  $103^{\circ}$  for a week or more. The temperature is more likely to subside by slow degrees than in the typical lobar pneumonia. We believe that septic emboli are the cause of most of these cases. They rarely begin earlier than the third or fourth day following operation. In addition to the above there were six deaths from pneumonia. We could not attribute any of these cases to the anæsthetic.

The total number of patients having pulmonary complications was 89 or .015 per cent. If we included the out-patients the pulmonary complications would be well under 01 per cent. It should be mentioned that ether is used almost exclusively in this clinic. The following tables show the operations in which lung complications occurred.

# COMPLICATIONS FOLLOWING OPERATIONS

7-

femoral or internal saphenous vessel. Our usual treatment for this condition has been elevation of the leg with hot applications. There were no cases of embolism the past year following phlebitis

## THROMBOPHLEBITIS

	Left	Right
Appendectomy	I	I
Appendectomy, curettage, perineorrhaphy	I	I
Cholecystostomy, int Alex curettage	I	
Drainage pelvic abscess	I	
Total abdominal hysterectomy	I	
Gastrectomy	I	
Cholecystostomy and appendectomy	I	
Cholecystectomy	I	
Kraske colostomy	I	
Tube and ovary, appendectomy, Wiley-Mann	I	
Ovarian cyst	I	
Mayo operation, prolapse	I	
Ventral hernia	I	
Cholecystostomy		I
Total	12	1

*Surgical Rash*—Surgical rash occurred 5 times during the year. Certain authors appear to attribute this condition to the use of soap suds enemata. It is rather surprising that this condition has not been observed more often considering the fact that soap suds enemata were used quite extensively in our clinic\*. As we have observed the rash, it more often simulates a scarlet fever eruption, although occasionally it resembles a well marked case of urticaria.

*Epididymitis* and *orchitis* were noted four times in the following operations: Excision of myoma of the bladder, excision of carcinoma of the bladder, a suprapubic prostatectomy, and an inguinal hernia.

*Acute dilatation* of the stomach, which formerly was often seen, was encountered but once during the year, this being in a case of cholecystostomy and posterior gastro-enterostomy for duodenal ulcer. We believe that we have been able to

\* Soap suds enemata are not now in routine use in this clinic.

Choledochotomy and cholecystostomy	1
Posterior gastro-enterostomy	1
Umbilical hernia	1
	<hr/>
Total	7

## LOBAR PNEUMONIA

Cholecystostomy, post-operative hernia	1
Cholecystostomy	2
Appendectomy	2
Wilm's operation	1
Cholecystostomy and appendectomy	2
Posterior gastro-enterostomy	2
Supravaginal hysterectomy	1
Entero-anastomosis	1
	<hr/>
Total	12

*Thrombophlebitis*—The total number of cases having a phlebitis following operation was 16. Although we continually have a certain number of phlebitis cases following operations we have not been able to determine any causative factor in this annoying complication. We have always taken a middle course so far as getting the patients out of bed early is concerned. Most laparotomy patients are kept in bed from 8 to 12 days, except those having simple appendectomies, who are allowed to get up on the sixth or seventh day following operation. It will be seen from the following table that exactly three-fourths of these cases of phlebitis were in the left femoral or internal saphenous vein and one-fourth in the right, none were double. This is about the usual proportion in our clinic. It has not been determined definitely that patients that have an infected wound or are infected at the time of the operation are more susceptible to phlebitis than so-called clean cases. We are often surprised to find a phlebitis develop in a patient that has otherwise had an ideal convalescence. In only one of the present series was there an infected wound. It will be noted that in one of these patients phlebitis occurred in the arm following an operation for perineal fistula. The other cases of phlebitis were in the

femoral or internal saphenous vessel. Our usual treatment for this condition has been elevation of the leg with hot applications. There were no cases of embolism the past year following phlebitis

THROMBOPHLEBITIS

	Left	Right
Appendectomy . . . . .	1	1
Appendectomy, curettage, perineorrhaphy	1	
Cholecystostomy, int Alex curettage	1	
Drainage pelvic abscess . . . . .	1	
Total abdominal hysterectomy . . . . .	1	1
Gastrectomy . . . . .	1	
Cholecystostomy and appendectomy	1	
Cholecystectomy . . . . .	1	
Kraske colostomy . . . . .	1	
Tube and ovary, appendectomy, Wiley-Mann	1	
Ovarian cyst . . . . .	1	
Mayo operation, prolapse . . . . .	1	
Ventral hernia . . . . .		1
Cholecystostomy . . . . .		1
	—	—
Total . . . . .	12	4

*Surgical Rash*—Surgical rash occurred 5 times during the year. Certain authors appear to attribute this condition to the use of soap suds enemata. It is rather surprising that this condition has not been observed more often considering the fact that soap suds enemata were used quite extensively in our clinic. As we have observed the rash, it more often simulates a scarlet fever eruption, although occasionally it resembles a well marked case of urticaria.

*Epididymitis* and *orchitis* were noted four times in the following operations. Excision of myoma of the bladder, excision of carcinoma of the bladder, a suprapubic prostatectomy, and an inguinal hernia.

Choledochotomy and cholecystostomy	1
Posterior gastro-enterostomy	1
Umbilical hernia	1
	—
Total	7

## LOBAR PNEUMONIA

Cholecystostomy, post-operative hernia	1
Cholecystostomy	2
Appendectomy	2
Wilm's operation	1
Cholecystostomy and appendectomy	2
Posterior gastro-enterostomy	2
Supravaginal hysterectomy	1
Entero-anastomosis	1
	—
Total	12

*Thrombophlebitis*—The total number of cases having a phlebitis following operation was 16. Although we continually have a certain number of phlebitis cases following operations we have not been able to determine any causative factor in this annoying complication. We have always taken a middle course so far as getting the patients out of bed early is concerned. Most laparotomy patients are kept in bed from 8 to 12 days, except those having simple appendectomies, who are allowed to get up on the sixth or seventh day following operation. It will be seen from the following table that exactly three-fourths of these cases of phlebitis were in the left femoral or internal saphenous vein and one-fourth in the right, none were double. This is about the usual proportion in our clinic. It has not been determined definitely that patients that have an infected wound or are infected at the time of the operation are more susceptible to phlebitis than so-called clean cases. We are often surprised to find a phlebitis develop in a patient that has otherwise had an ideal convalescence. In only one of the present series was there an infected wound. It will be noted that in one of these patients phlebitis occurred in the arm following an operation for perineal fistula. The other cases of phlebitis were in the

# COMPLICATIONS FOLLOWING OPERATIONS

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	Total No of Cases	No. of Cases	
Operations on breast . . .	285		
Amputation for carcinoma (Halsted)		101	
Operations on back . . .	38		
Operations on chest ....	66		
Empyema, decortication of lung		4	
Empyema drain . . .		8	
Operations on rectum, such as hemorrhoids, abscesses, etc . . . . .	234		
Operations on male genital organs	180		
Minor gynæcological . . .	599		
Perineorrhaphy . . .		178	
Miscellaneous operations, such as tapping for ascites, abscesses, etc	150		
Operations on extremities	321		
Femur, ununited, Lane splint ...		6	1
Halsted's metal band for occlusion of femoral artery . . .		1	1
Operations on stomach . . .	242		
Gastro-enterostomy for chronic ulcer		40	1
Gastro-enterostomy, closure of		10	1
Gastro-enterostomy for carcinoma		31	2
Gastrostomy		8	1
Gastrectomy, partial, for carcinoma		46	1
Operations on first portion of duodenum	223		
Gastro-enterostomy for chronic and subacute ulcer and its results		187	1
Acute perforating ulcer, sutured and gastro-enterostomy		6	1
Ulcer excised and pyloroplasty		20	1
Operations for appendix	*977		2
Acute and suppurative appendicitis		547	
Chronic appendicitis		430	
Operations on small intestines	73		
Resection fistulæ with obstruction ...			
Intestinal obstruction, acute and chronic		1	
Intussusception, ileum into colon, acute		1	
Laparotomy for diffuse septic peritonitis			
Jejunostomy . . . . .			
Traumatic rupture, small intestine sutured		1	
Exploration, carcinoma, irreducible			



avoid this serious complication by early and frequent washing of the stomach. Whenever a patient has vomiting or regurgitation of bitter fluid from the stomach, although there is no real vomiting, routine lavage is employed.

Scarlatina occurred once following a small skin grafting operation. One patient on whom an appendectomy had been done had an arthritis which affected some of the joints but subsided in a few days. A perineal abscess developed in a patient who had had an abdominal resection of the sigmoid. Another patient on whom a vaginal hysterectomy had been performed developed a general furunculosis. Three cases, one an amputation of the breast, one a block dissection of the neck, and the third a spermatocele, developed a mild cellulitis.

Three patients developed a tonsillitis following their operations, one was an abdominal hysterectomy, one was a ligation of the superior thyroid artery, and the third was a shortening of the round ligaments and perineorrhaphy.

TABLE SHOWING NUMBER OF OPERATIONS ON REGION OR ORGAN, THE OPERATIONS FROM WHICH THERE WERE FATALITIES AND THE NUMBER OF DEATHS THEREFROM. THE NUMBER OF DEATHS REPORTED ARE ONLY THOSE WHICH OCCURRED IN THE HOSPITAL.

	Total No of Cases	No of Ops	No of Deaths
Operations on cranium	64		1
Craniotomy		9	1
Trephining for fracture		5	1
Operations on eye	187		
Operations on face	569		
Operations on neck	566		
Sarcoma, glands excision		3	1
Tuberculous glands excised		105	1
Operations on thyroid	1249		
Thyroidectomy for carcinoma		2	1
Single ligation thyroid vessels		363	5
Thyroid carcinoma, exploration		4	2
Thyroidectomy goitre, including the thy- rotoxic type		594	7
Thyroidectomy, exophthalmic		275	1

# COMPLICATIONS FOLLOWING OPERATIONS

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Operations on breast	285		
Amputation for carcinoma (Halsted)		101	
Operations on back	38		
Operations on chest	66		
Empyema, decortication of lung..		4	1
Empyema drain ..		8	1
Operations on rectum, such as hemorrhoids, abscesses, etc	234		
Operations on male genital organs	180		
Minor gynæcological	599		
Perineorrhaphy		178	1
Miscellaneous operations, such as tapping for ascites, abscesses, etc	150		
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Halsted's metal band for occlusion of femoral artery		1	1
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Gastro-enterostomy, closure of		10	1
Gastro-enterostomy for carcinoma		31	-
Gastrostomy		8	2
Gastrectomy, partial, for carcinoma		45	-
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Acute perforating ulcer, sutured and gastro-enterostomy		6	1
Ulcer excised and pyloroplasty		20	
Operations for appendix	977		
Acute and suppurative appendicitis		317	2
Chronic appendicitis		446	-
Operations on small intestines	78		
Resection fistulæ with obstruction		6	-
Intestinal obstruction, acute and chronic		-	-
Intussusception, ileum into colon, acute		-	-
Laparotomy for diffuse septic peritonitis		-	-
Jejunostomy		-	-
Traumatic rupture, small intestine su- tured		-	-
Exploration, carcinoma, irremovable		-	-

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Operations on thyroid	1249		
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Single ligation thyroid vessels		363	5
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Thyroidectomy goitre, including the thy- rotoxic type		594	7
Thyroidectomy, exophthalmic		275	1

# COMPLICATIONS FOLLOWING OPERATIONS

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	Total No of Cases	No. of Deaths	%
Operations on bladder and prostate	185		
Cystotomy, suprapubic, for calculus and pyelitis . . . . .		23	12
Cystotomy, suprapubic, for retention and cystitis . . . . .		24	22
Carcinoma bladder, suprapubic resection		2	1
Papilloma bladder, malignant		6	1
Prostatectomy, suprapubic		79	4
Prostatectomy and cystostomy, supra- pubic, for hypertrophied prostate, cal- culus, cystitis and pyelitis		4	2
Total number of operations . . . . .	8703		
Total number of deaths following operation			112
Cases not operated but dying in hospital			
Total number of patients operated on	7053		
Number of in-patients	5835		
Number of out-patients	1218		

# ABOLISHING PAIN AFTER OPERATIONS WITH NERVE BLOCK *À DISTANCE*.

BY LEIGH WATSON, M.D.,  
OF OKLAHOMA CITY

THE abolishing of pain after operations is one of the most important if not the most important problem with which modern surgery has to contend. By the application of a simple and efficient nerve block *à distance*, which can be successfully used by any physician, the most painful and annoying after-effect of surgical operations is eliminated. We are careful to select the safest anæsthetic, choose the best operation, perform it as skilfully and expeditiously as possible under a rigid aseptic technic, in fact, nothing is left undone that will add to the safety of the procedure and the prompt healing of the wound. At the same time nothing has been done to relieve the patient of the post-operative pain, which has become accepted as a part of the operation itself, a necessary evil, to be endured as a matter of course. The post-operative pain is one of the most unpleasant and disagreeable remembrances the convalescent has of his operation, and in reality it is the most distressing pain the patient is compelled to bear. I have had patients tell me that the pain of an acute attack of appendicitis was not as severe as that of the first day or two following the operation. Unfortunately the majority of people who require an operation are handicapped by disease, injury, age, or shock. These patients are least able to withstand pain, and it is particularly in this class of cases that the nerve block *à distance*, for the prevention of pain after operation, will find its greatest usefulness.

Before beginning the operation the entire line of incision is anæsthetized with a weak cocaine, one-tenth per cent, or novocaine, one-fourth per cent, solution with adrenalin, even though general anæsthesia is used for the entire operation.

upper intestinal tract Indurated gastroduodenal ulcers necessitate resection of the involved portion If the diseased area is in an accessible position, it is excised, and plication of the duodenum and posterior gastro-enterostomy performed Of all the cases of duodenal ulcer reported here there was not a single instance in which excision could have been carried out with any degree of safety on account of the close proximity of the duodenal involvement to the head of the pancreas Basing our opinion on the statement of Wilson and MacCarty that 71 per cent of gastric cancers result from cancerous change in the bases of chronic ulcers, we have estimated from American statistics that 13,940 persons die annually in this country of cancer of the stomach secondary to ulcer The time to treat carcinoma of the stomach is in the pre-cancerous, ulcer stage The surgical treatment is excision of the ulcer bearing area, pylorectomy, in cases involving the pyloric end or gastroduodenal segment, simple excision if the anterior wall is involved higher up In either event the duodenum is plicated and gastrojejunal drainage established In several cases of very slightly indurated gastric ulcers we have omitted the excision, but these cases were operated before the clear demonstration of the rôle played by ulceration in the development of cancer The establishment of dependent drainage compensates for the altered motility in cases of partial resection and in the rarer simple cases insures a measure of rest Nature probably conserves the gastric function to the ingesta by the gradual institution of sphincter action at the gastro-jejunosomy opening Until this has occurred, the ulcer or incisional area has been placed under the best possible condition for rapid healing Seventeen of our 19 operated cases have been subjected to the complete operation and without a death One case died after simple closure of the perforation Another recovered after a two-stage operation The history is as follows:

A W, male, aged thirty-four years, was admitted to the hospital on June 8, 1911, in a state of collapse His condition was precarious An almost imperceptible pulse grew stronger, the

as though no anæsthetic had been used. The entire subjective mind is unanæsthetized and sensitive to the slightest trauma, with the resultant nervous shock.

With the patient under general anæsthesia one is often tempted to make an incomplete nerve block, especially when the patient has been anæsthetized for a considerable time. When the urea and quinine is hastily or carelessly injected nerves will usually be left unblocked. The pain and shock vary inversely with the completeness of the nerve block.

After an amputation of the breast for chronic mastitis, under local anæsthesia, I have purposely allowed a partial return of sensibility, the nerve block *à distance* was then used, and in a few minutes the patient was free from pain and remained so for several days. The use of sedatives and opiates is unnecessary, because pain is absent. With a comfortable and painless convalescence it is reasonable to presume that, as it becomes generally known that the post-operative pain can be eliminated, surgery will lose much of its dread, and perhaps operations will become more popular.

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting held January 6, 1913*

President, DR GWILYM G DAVIS, in the Chair

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### CARCINOMA MASTITOIDES

DR MORRIS BOOTH MILLER remarked that Dr Schuman in a recent paper before this society clearly discussed the known clinical and pathological factors involved in cases of carcinoma mastitoides and gave abstracts of the previously published cases, twelve in number, including his own. To these he wished to add two cases, one of his own, and one which he had through a personal communication from Dr Barton Cooke Hirst.

Briefly it may be defined as a rapid, almost fulminating form of mammary cancer occurring as a rule in the pregnant or puerperal woman which presents, at least during some portion of its course, a breast which resembles in a striking manner either acute or subacute purulent mastitis. It generally arises suddenly, it always progresses swiftly, and the end is early death with or without operation.

CASE I—K B, aged thirty-six, was seen at the Polyclinic Hospital on September 23, 1912, complaining of enlargement of the right breast. The family history was excellent. The patient had been married fifteen years, and borne three children, all of whom were living and well, and had had one miscarriage. Her babies were breast fed, she had never had any trouble with either breast.

She was several months pregnant. About two weeks after her last period she noticed that the right breast was larger than the left, especially about the upper and outer portions. This enlargement gradually increased and soon there commenced con-



tinuous pain, with exacerbations, more recently referred to the axilla. Support and rest gave relief.

On the examination the whole right breast was uniformly enlarged from the sternum to the mid-axillary line. The skin over it was like pigskin, the feel was hard but not nodular, the surface was distinctly warmer than over the other breast, it was infiltrated, brawny, and dusky red, the nipple was retracted; the axillary and supraclavicular nodes were enlarged. In general appearance it closely resembled a neglected mastitis (Figs 1 and 2).

Later ulceration appeared in the region of the nipple and immediate operation was postponed because it was believed a still birth would result. Judging from the probable character of the disease and its evident extent it seemed quite probable that her life would be forfeited anyhow and therefore the life of her unborn child was of first consideration. It was therefore agreed that she was to be kept under observation for a month when, in Dr Nicholson's judgment, premature labor could safely be induced.

She was kept under observation for one month more and then admitted to the hospital on October 26, labor was induced on the 27th and on the 28th she was delivered of a healthy female child who weighed on the fourth day four pounds and six ounces. On November 4 under ether anæsthesia a large dinner-plate incision was made extending in three lines from the sternum, the clavicle, and the posterior axillary line. The whole breast was rapidly cut away clean from the chest wall. The axilla was dissected out both toward the clavicle and backward toward the scapula. It was seen that the nodal involvement was widespread, extending well above the first rib and therefore a prolonged and painstaking dissection was not attempted. By undercutting and the careful approximation of the flaps only a moderate sized triangular area was left uncovered. Recovery was interrupted and she was discharged on November 27, with a small granulating area still open. One month later there were already evidences of recurrence in the scar.

A pathological report by Dr John A. Kolmer shows the presence of a relatively small amount of connective tissue stroma and dense infiltration with irregular masses of epithelial cells of

the squamous celled type The normal structure of mammary tissue with acini and ducts is entirely lost In the superficial portion there is an area with total loss of epiderm and an ulcer characterized by leucocytic infiltration, extravasated blood and fibroblasts This ulcer extends into the carcinomatous area Sections of lymphatic gland show a capsule and narrow strips of lymphoid tissue, the major portion of the gland being infiltrated with masses of epithelial cells

CASE II—Dr Barton Cooke Hirst's patient had borne eight children He saw her for the first time eight months after the last delivery The malignant disease of the breast had begun two weeks after the infant was born and was treated for some time as an abscess When she came under observation the condition was inoperable, there being extensive involvement of the glands of the neck

A good illustration in colors of this case appears in the 7th edition of Dr Hirst's Text Book on Obstetrics.

DR. WILLIAM L RODMAN remarked that he did not believe that this condition was as rare as was formerly thought, though of course, it was rare in comparison to the ordinary form of carcinoma First, one should accurately differentiate between the true genuine carcinomatous mastitis, which does look very much like an inflammatory process from the beginning, and those cases of distinctly localized or discreet processes which may be outlying in the periphery of the breast and some of which, under the influence of pregnancy, take on later the seeming characteristics of acute carcinoma In his opinion carcinomatous mastitis is just about as common in the non-pregnant as in the pregnant woman, in fact, of the four cases seen by him, three were women forty-five years of age, one had not been pregnant for 25 years, and another non-pregnant for 24 years, both had borne living children and neither had had miscarriages subsequently The third case was seen in Dr Estes' clinic, this patient also was about forty-five years of age The case was brought into the clinic under the impression that it was an abscess but, on lancing it, there was no pus present and a complete amputation was done

In all of them the breast presented the same appearance, brawny, red and indurated, the skin having an appearance very much like orange peel, with indentations here and there All three

cases died very quickly in spite of operation. The first case died 3 months after operation with extensive metastasis to neck, lungs, and liver. A fourth case began as a discrete process at the sternal end of the gland, and at the expiration of the fourth month of pregnancy the entire gland was involved, her husband, a medical man, insisted on operation, she had a rapid metastasis to the liver and that with the pregnant uterus filled the abdomen very shortly after operation. At the 7th month of gestation the speaker was summoned by Dr Nicholson and, finding her discomfort so great, concurred in his opinion that premature labor should be induced, she lived but a few weeks thereafter. Dr Estes' case likewise lived but a few months after operation. The second case lived a year apparently in good condition, when there occurred involvement of the opposite breast which was removed. She died six months after the second operation. The prognosis in these cases is most deplorable, not one having been saved to his knowledge, yet if the cases are seen early enough, as the last case just referred to, who was seen within three weeks after discovery of the growth, there is more chance of prolongation of life and a possibility of cure.

The essential point is that the form of carcinomatous mastitis under discussion is to be differentiated from the local and discrete growth which is stimulated by pregnancy.

DR ASTLEY P. C. ASHHURST stated that through the kindness of Dr Miller and of Dr Skillern he had seen this patient some months before operation, at which time she was pregnant about six months, and remarked that unless he had been told that it was a case of carcinoma mastitoides he should not have known it, that it seemed to him like an ordinary carcinoma simplex, neither a scirrhus nor an encephaloid. The microscopical examination showing that the tumor was composed of squamous cells, is certainly an unusual finding.

DR MILLER, in closing, stated that he had gone over the pathological reports in some of the reported cases of this condition and found that there was a variety of cells concerned in this process, but in all there was leucocytic infiltration and sometimes abscess formation. Apparently the differentiation of carcinoma mastitoides is not a pathological but a clinical one, depending upon certain factors regarding which there is but little known.

## LUXATION OF THE PATELLA

DR MILLER, in reporting this case, stated that traumatic luxation of the patella occurred in three forms (1) Lateral displacement, (2) rotary displacement, (3) backward displacement, with wedging of the patella between the tibia and femur. Of these lateral displacement is the most common and the case reported illustrates this type. When dislocated laterally it may be inward or outward, and complete or incomplete, depending upon whether the patella is in contact with the condyle or still touches the joint surface. Inward luxation is very rare and this rarity may be attributed to the greater size and more rounded form of the inner condyle, furthermore, the inner edge of the patella is thicker and hence more exposed to violence, and, finally, in the normal leg the extensor apparatus lies a little to the outer side of the midline and hence outward displacement can more rapidly occur. In the reported cases the violence causing these lesions may be described as a direct blow to the patella with sudden forcible contraction of the quadriceps, while the knee is bent and perhaps turned inward. In direct ratio to the completeness of the luxation the capsule is torn longitudinally and sometimes the extent of this tear may be felt through the skin. The knee is somewhat bent inward and there is a tendency to outward rotation of the foot. The patella is found on the outer side of the condyle and the trochlea is empty. Naturally in incomplete luxation the symptoms are less pronounced.

A much rarer form is that of rotary displacement where the patella is rotated on its long axis and stands vertically on its edge in the trochlea, or, in extreme cases, it may turn completely over so that its cartilage covered surface is beneath the skin. The rotation may occur inward or outward with equal frequency. There is tearing of the capsule longitudinally on the side from which the patella rotates, or in the extreme instances where rotation is complete the capsule is torn on both sides. The character of the causative factors seems the same as in lateral displacements. Reduction is sometimes easily accomplished by simple manipulation with the hip flexed and the knee hyperextended, but more often it is difficult and only possible with rather extensive open operation.

The third type, that of backward displacement with wedging of the patella between the tibia and femur, is so infrequent that only four cases have been placed on record. In these cases the patella was driven into the joint by rotation on its transverse axis and the joint surface of the patella faced upward. Passive extension was impossible. In Szuman's case, which is accepted as typical, the crucial and external lateral ligaments were ruptured. Reduction has been done by manipulation after cutting the patellar tendon.

The present case was in the person of a well developed man of 28 years who was admitted to the Philadelphia Hospital, December 17, 1912, with the history that in July, 1912, he fell off a wagon and violently struck his right knee on the cartway. He received no treatment other than a bandage.

On admission the right limb showed moderate atrophy of the quadriceps, at the most amounting to 5 cm. less than the well leg. The calf measured 1 cm. less than its fellow. With the leg extended the difference in appearance between the two knees was not great, although the patella could be seen about half its diameter external to its normal position. On flexion, however, the difference was marked and caused a curious broadening of the knee (Fig. 3). The patella rested upon the epicondyle, and both the quadriceps and patellar tendons were tense and deflected to such an extent that they formed an obtuse angle with each other. The greater part of the surface of the femoral condyles, including the intercondylar notch, could easily be palpated and the sharp edge of the tibia could be both seen and felt (Fig. 4). There was no effusion, no tenderness and no appreciable thickening of the ligaments. With the limb extended there was some turning outward of the foot and a slight degree of genu valgum was present. Very little disability attended this unreduced displacement. The patient said he was able to do everything he did before the accident except to walk up and down stairs easily. He showed some weakness in voluntary extension.

Under ether anaesthesia an attempt was made to reduce the luxation by manipulation, while the limb was flexed on the body with the knee straight. The patella could be pressed back into its place but as soon as released the condition recurred. It was seen that a permanent reduction could only be accomplished by

Whenever possible I begin and finish the operation with local anæsthesia alone, because the nerve block *à distance* is easier and usually more thorough with the patient awake and able to tell when the analgesia is complete. A sterile solution of urea and quinine hydrochloride, one-half to one per cent, is injected with a long needle into each layer of tissues, one or two inches from the margin of the wound, as it is sutured. Solutions weaker than one-half of one per cent have proven unsatisfactory, the analgesia is uncertain and of too short duration. The urea and quinine provides a complete nerve block, and as the solution does not come in contact with the cut surfaces it does not interfere with the healing. With this method the single advantage possessed by urea and quinine as a local anæsthetic—prolonged analgesia—is utilized without its disadvantages. Post-operative analgesia persists longest when the urea and quinine is infiltrated in this manner. It is well known that a local anæsthetic lasts the longest in tissues that are not cut. The analgesia continues for three to seven days. By the time the nerve block *à distance* has lost its effect, healing has progressed sufficiently to make further anæsthesia unnecessary.

Next to the operation itself, the post-operative pain is the principal factor with which we have to contend in the production of shock. The nerve block *à distance* prevents post-operative stimulation of the brain cells, therefore, there can be no after pain or shock and exhaustion of the subjective mind. The lessening of shock reduces the mortality rate, and renders border-line cases under the old methods safe risks with the nerve block. The importance of this is evident when one considers the number of cases operated on each year in which the outcome is uncertain or doubtful when they go on the table. Crile says, under general anæsthesia the patient may not move when you cut unblocked nerves, but there will be the same degree of shock as though he was cut without any anæsthetic whatever being used. It must be remembered that with inhalation anæsthesia the greater part of the brain is awake and responds to injury just the same.

in which there was a double habitual luxation of the patella. He opened the knees and sutured the longitudinal tear and overlapped after the method of Mayo in umbilical hernia. He had a rather unsatisfactory result. He thought he might have obtained a better result had he transplanted the insertion of the patella tendon at the tibial tubercle to a point on the inner surface of the head of the tibia.

### INTERPARIETAL HERNIA

DR MILLER prefaced the report of his third case with the following résumé of the subject.

To that form of inguinal hernia in which the sac is in the abdominal wall is applied the term *interstitial* or *interparietal* hernia, and several varieties have been carefully studied by Gobell, Macready, Kuster, Breiter and others.

Interparietal hernia, broadly speaking, comprises three varieties, but these have further subdivisions. The three forms are, first, where the sac is in the loose connective tissue between the peritoneum and the transversalis fascia, the *properitoneal* type; second, where the sac is found between the muscle layers of the abdominal wall, the *intermuscular* type, and, third, where the sac is in the loose connective tissue between the external oblique and the skin, the "*inguino-superficialis*" type of Kuster.

We are mainly indebted to Kronlein for our knowledge of the *properitoneal* hernias. Something over 70 cases have been reported of which Holder and Breiter have collected 40. As a rule, they have only been recognized at operation, usually for strangulation or during radical cure operations. And the reason for this is obvious, since the presence of *properitoneal* hernia may give rise to no phenomena save in the event of strangulation. Dr Francis S. Stewart reported before the Academy of Surgery on January 4, 1909, a case of intestinal obstruction due to a strangulated *properitoneal* hernia upon whom he successfully operated.

Briefly summarized it may be stated that this variety of *interparietal* hernia occurs in the large majority of cases in males and nearly a third of these have *mal descended* testicles, in nearly all the sac is *bilocular*, one portion being concealed behind the *transversalis* fascia, as the *properitoneal* pocket, while the other por-

open operation. This was suggested and refused. It seemed probable that the suturing or plication of the torn capsule with transference of the tibial tubercle with its patellar tendon to a new site, to the inner side of the tibia, might have given a permanent cure.

DR W G ELMER inquired what mechanism of muscular action produced rotary dislocation of the patella and the inner or the outer edge more likely to be anterior? He had seen a patient lying helpless on the ground, whose patella had been turned directly on edge by muscular action, the result of slipping.

DR G G DAVIS recalled having seen a patient who had several years previously luxated his patella. It was lying on the outer side instead of on the front of the condyles. The advisability of operation was suggested but refused, as the knee had such good function. This bears out Dr Miller's experience as regards the restoration of function after these injuries. Another case was a young woman who had had hip disease in childhood with absorption of part of the head and neck of the femur. The distance between the knee and pelvis being lessened resulted in a loosening or relaxation of the quadriceps tendon. When such a person stands up with the knee fully extended the patella sags somewhat, and if there is a quick, sudden contraction of the quadriceps it will pull the patella over the side of the condyle. Then by placing the foot firmly on the ground and hyperextending the knee and giving the quadriceps a jerk the patella jumps back again into normal position. That is not a traumatic condition, but may occur in cases of hip-joint disease. Extreme knock-knee is another affection in which it occurs.

DR MILLER, in closing, said that there was an anatomical reason why the external luxation occurred more frequently than the internal, based on the fact that the internal condyle is larger and more rounded, the midline of the extensor muscle is a little to the outside, and there is no place for the patella to lodge. With the complete reversals there is no reason why these should occur one way more than the other, from the inside or *vice versa*. The speaker was glad that Dr. Davis had called attention to the congenital type, there was also a recurrent type occurring after traumatic luxation. In these cases if there is much disability operation is indicated. Bunts, of Cleveland, recently reported a case



testicle is also found, but the disproportion between male and female examples is not so marked as in the other forms

CASE REPORT—A woman of forty-two years was admitted to the Philadelphia General Hospital on December 17, 1912. In the right groin there was an irreducible hernia of an unusual type. She stated that it had made its appearance as a small lump immediately following the birth of a child about twenty years ago. At first it was small and apparently partially reducible but it gradually grew larger and during recent years had shown no tendency toward reduction. It had not caused pain or inconvenience except now and then from the pressure of her clothing.

The tumor mass was 9 cm long, 4 cm across at its base, and rose 5 cm from the surrounding surface (Fig 5). It lay nearly parallel to *Poupart's ligament*, but the lower margin did not quite reach it. It was somewhat pedunculated. The skin covering it was somewhat thin in places but in others it was quite thick. The contents were entirely irreducible and had the characteristic feeling of adherent omentum. There was no tenderness to manipulation. While the tumor possessed a long base it was easily determined that the attachment to the external oblique was in appearance only and that the inner portion, for at least two-thirds, had no deep connection and that the neck of the sac was situated near the upper and outer edge, at a point which seemed well outside the location of the internal ring.

On December 21, 1912, the speaker operated under ether anesthesia. An elliptical incision beyond the limits of the hernia exposed the sac, and that portion which had extended toward the median line was lifted outward until the neck appeared. The sac was then opened and was found to have numerous trabeculae along the walls. The contents consisted entirely of omentum which was widely adherent. This was tied off and the margins of the hernial opening, which was nearly circular and about 2 cm in diameter, were freed of the adhesions. An intra-abdominal exploration showed that the location of the opening was distinctly external to the internal ring as estimated by its distance from the deep epigastric artery, certainly 6 or 7 cm. Apparently this would place it in the category of Schmidt's case previously mentioned. Inasmuch as the aponeurosis was not opened the condition of the internal oblique cannot be stated further than to note that there seemed a deficiency about the opening and





tion is external and appears as an ordinary hernia. Several theories have been advanced to explain their formation. In some it would seem that the narrowing of the neck of the sac of an external hernia due to various causes, of which the pressure of a badly fitting truss is easiest to imagine, a diverticulum is created and constitutes the properitoneal sac. In others reduction in mass may account for it. But in the vast majority of cases properitoneal hernia is a congenital condition, associated with other congenital defects such as maldescent and the occurrence of ordinary hernia. Properitoneal hernia in the femoral region has been reported in 10 cases, all in women.

In the intermuscular variety the usual site of the sac is between the internal oblique and the aponeurosis of the external oblique. However, according to Gobell, in addition to this location the sac may be found between the internal oblique and the transversalis, or between the transversalis and its fascia. In the instances where a hernia of this type attains considerable size there is often muscle atrophy amounting to the practical disappearance of one or more layers. This variety appears as an oval swelling, which does not project much from the surface, lying above and parallel to Poupart's ligament. Some of the sac may pass, to a small extent at least, into the scrotum or labia.

Of Gobell's 115 cases, 111 were in males, two-thirds were on the right side, and with more than half of these there was maldescent of the testicle. Again the congenital element as a causative factor stands out prominently, but it is certain, however, that some were due to awkward attempts at taxis and other similar external causes.

The third variety is more readily diagnosed than either of the other two, as the sac lies on the external oblique aponeurosis and is merely covered by skin and superficial fascia. A round or oval or sausage shaped tumor, which projects as a rule considerably above the surrounding surface, is found above but not necessarily exactly parallel to Poupart's ligament. The sac may extend either inward or outward from the neck, which is usually at or near the internal ring. In a case reported by Schmidt the location of the internal ring was displaced upward and outward toward the anterior superior spine. This type of hernia is always congenital and does not become scrotal or labial. Undescended

deaths were considered, every case operated on under 24 hours recovered and those operated on later died. Ten cases were his own and since then he had had four others, two recovering and two dying, the two which recovered were operated under 24 hours, and the two that died were operated, one 24 and one 18 hours, therefore, he had had one death in a case operated under 24 hours. One patient died suddenly on the twelfth day. Autopsy showed peritoneal cavity perfectly clean and wound was entirely healed. The other death occurred on the tenth day, and was sudden, no autopsy. The main factor in saving these cases is the time which elapses between perforation and operation. Another point influencing the mortality rate is the time spent in operating. A great many of these cases are saved now which formerly would have died because of the prolonged toilet of the peritoneum which was formerly practised. Relative to the diagnosis of ulcer, he believed that the absence of liver dulness was of the greatest diagnostic value, provided it was accompanied by a scaphoid and rigid abdomen. The presence of liver dulness was no indication that there was no perforation present. In the differential diagnosis he thought there was often difficulty in excluding gall-stone colic. He had seen two such cases, one sent in as gall-stone colic on whom he operated thinking he had a perforation. The rigidity of gall-stone colic is relieved by morphia, but in gastric or duodenal ulcer the rigidity remains absolute.

With regard to gastro-enterostomy he said that he had not practised this. Four of the cases had this operation performed upon them, but of his 14 personal cases, extending over ten years, but one was subjected to immediate gastro-enterostomy. He had operated on but one since the primary operation, doing a gastro-enterostomy, and had followed the history of these cases very carefully. All have remained well with the one exception mentioned, who turned up 18 months after the primary operation with gastric symptoms. To draw conclusions as to the advisability of a procedure like this we must have more cases. He believed that there was another element to be considered, the experienced operator can do a gastro-enterostomy in the presence of an acute perforation operated upon within 24 hours and save the patient, but if this were generally practised the mortality would be very high. It had always seemed to him bad practice to open the lesser peritoneal cavity when the greater peritoneal

there were no muscle fibres to be seen in any part of the sac. After the sac was cut away the opening was closed by two mattress sutures of chromic catgut overlapping the margins freely. The woman made an easy recovery.

It is, of course, apparent that this case was one of the superficial type of interparietal hernias in which the sac extended inward from the hernia opening and was situated between the aponeurosis of the external oblique on one side and the two layers of the superficial fascia and the skin on the other. It was the opinion of the speaker that it was probably due to a congenital defect, but that the appearance of a tumor of sufficient size to attract the attention of the woman did not occur until after child birth.

DR. CHARLES F. NASSAU reported that he had had experience with only one of these cases, although he did not recognize it on examination. The tumor extended from the outer side of the lining of the canal between that and the crest of the ilium, being about the size of a large fist. It was tympanitic, and he believed it was some kind of separation in the abdominal wall. After incising the skin and clearing the aponeurosis of the external oblique he found the hernia had come out of the external ring, was indirect, and had turned upwards under the external oblique for a considerable distance, containing a good deal of bowel. Of course the condition is not always so easily recognized, not long after this a second case presented itself which seemed to be of the same nature but which turned out to be an abscess containing gas. With regard to the commoner forms of epigastric hernias he had operated upon three and had assisted in another. The statement made by Dr. Miller that they do not cause trouble unless strangulated is open to question. All of his own cases complained considerably and not one was strangulated.

#### REPORT OF 25 CASES OF ACUTE PERFORATED DUODENAL AND GASTRIC ULCER OCCURRING AT THE GERMAN HOSPITAL

DR. JOHN B. DEEVER read a paper with the above title, for which see page 703.

DR. JOHN H. GIBBON referred to his experience which was reported in 1909 with Dr. Stewart at the meeting of the American Medical Association in Atlantic City, when 22 cases with 10

treatment of ulcer Dr Deaver's experience tempts me to be more radical in the future

DR D L DESPARD reported as relevant to the discussion a case in which he had operated upon a child for acute appendicitis, eighteen months previously, the wound having been closed without drainage, and which recovered without complications.

Yesterday afternoon the same child was admitted to the Jefferson Hospital in the service of Dr John H Gibbon with the history of having been suddenly seized with a severe abdominal pain the previous afternoon, and of having vomited once after taking some medicine, there was board like rigidity of the abdominal muscles, dulness in both flanks, the abdomen scaphoid in appearance and obliteration of the liver dulness

From the condition he felt that a perforation of the intestinal tract must exist, but with the exception of a history of indigestion for the past five years he had nothing to guide him This, with a more marked rigidity on the left side about two inches below the umbilicus, made him feel that the stomach was the probable site He consequently explored the upper abdomen first and found it full of pus but no lesion of any kind He made a second incision over the point of greatest rigidity below the umbilicus on the left side Nothing was found in the pelvis or in the appendix region to account for the condition, but a loop of the ileum was found distended and thickened This was found to be caused by a fibrous band almost occluding the lumen of the gut, proximal to which was a perforated ulcer

Dr Deaver spoke of the intense rigidity over the immediate site of the perforation If he had been guided by this observation he would have opened at once over the perforation and valuable time would have been saved

DR ASTLEY P C ASHHURST said that he had observed one clinical factor of interest in these cases of gastric or duodenal ulcer, namely, that in some patients the duodenal perforation developed some months or years after an attack of appendicitis In the first case in which he operated for duodenal perforation, Dr Frazier had removed the appendix just a year before in an acute attack Owing to this history he diagnosed intestinal obstruction Opening the abdomen in the hypogastric region he found intestinal contents free in the peritoneal cavity, then recognizing the nature of the case, opened over the pyloric region and

sutured the perforation. This year a patient from whom he had removed the appendix three years previously was admitted for gastric symptoms. Dr. Frazier operated on him, finding a sub-acute perforation of the duodenum, into adhesions. These are two cases in which the duodenal lesion seemed dependent on the previous appendicular infection.

Although the second case of duodenal perforation was diagnosed as appendicitis by the Resident, he did not repeat the error of his first case, but made a correct diagnosis before operation, basing it largely on the intense pain and the board-like rigidity of the abdominal muscles. The third case in which he operated was a patient of Dr. Neilson. He did not need to make a diagnosis from the physical examination, but simply looked at the patient's teeth, and said, "Any man with teeth as bad as that must have a duodenal ulcer." The man had all the classical symptoms, and a perforation of the duodenum was found. This patient was the only one of the three who died, and he suspected that his death was due to the fact that the drain was removed at the end of 48 hours. Up to this time the patient had done very well, though sixty-four years of age, but he died 6 hours after this occurrence with symptoms of grave sepsis.

All three of these cases were operated on within 5 or 6 hours after perforation, and in none of them was gastro-enterostomy done. The first patient had no gastric symptoms for the three years following operation, and the second had none for the six months after operation. They have not been seen since.

Dr. Gibbon has spoken of the question of pus in the abdomen as a contra-indication to gastro-enterostomy. As a matter of fact, in a great many of these cases the pus is sterile. In the two patients of his own who recovered, the pus was found to have been sterile, in the case of the patient who died the culture from the upper abdomen was sterile, but that from the pelvis showed a mixed infection, chiefly colon bacillus.

Dr. Deaver strenuously advocates gastro-enterostomy in these cases on the ground that it prevents subsequent trouble. It may be pertinent to ask whether his patient who was operated on three times for perforation had had a gastro-enterostomy done at the first or the second operation.

In reply to Dr. Jopson's suggestion that the relation of appendicitis and duodenal ulcer which has been referred to is to be



*Operation* (December 5, 1912) —The usual arthroplasty was done. The U-shaped incision was made Trochanter divided with chain saw and retracted out of field. The ankylosis was complete, *ie*, only the upper three-fourths of the head of the femur was involved in a bony ankylosis, the lower one-third in a fibrous ankylosis. The ankylosis was freed with a curved chisel, the normal conformation of the acetabulum and head of the femur was restored with the reamer and end mill. A flap of fat and fascia was dissected free from the under surface of the U-shaped skin flap and interposed between the acetabulum and head of the bone and sutured to the margin of the acetabulum and the remnant of the capsule on the neck of the bone. The trochanter was nailed back in place.

The wound was closed and the hip dressed in the usual manner. The patient was placed in the travois splint with a Buck's extension and a 25-pound weight attached on the leg.

Stitches were removed after four weeks (Fig 17). Primary healing. Good motion in hip. When the patient left the hospital seven weeks after the operation she had normal motion in the hip and she could bear her full weight on the leg. She could swing her leg freely in all directions—in fact, it was impossible to detect which hip had been operated on (Figs 18 and 19).

CASE IV.—Mrs A C, aged 37, had all of the childhood diseases. Pneumonia at eight years of age. No typhoid, scarlet fever or diphtheria, no rheumatism. Jaundice seven years ago, lasting three weeks. Confined to bed for one week with nausea and occasional vomiting. Fever but no chill. Cannot remember having any pain during attack. Entire body was very yellow. Jaundice gradual in onset, reaching its acme and then disappearing gradually. Thinks fever, nausea and vomiting came on before she noticed jaundice. This was only attack she has ever had. Has had frequent attacks of tonsillitis since childhood. Has often had her tonsils incised for peritonsillar abscesses. Attacks have not been so severe during past three years, but tonsils always swell when she has a cold. No history of middle-ear disease, alveolar abscess, sinus infections. Spider bite on left leg seven years ago, followed by swelling of leg, lasting about six weeks, during which time she could not walk on it. No previous operations or injuries.

cavity is filled with pus, and this also prolongs the operation about twenty minutes. He had talked with Mayo about this, who is convinced that if the ulceration is turned in and constricted the case will recover. Whether or not a gastro-enterostomy should be done is a question not yet settled. He believed the constriction of the ulcer, cutting off the blood supply and then starving the patient for two weeks, feeding by rectum (one of his cases did not get a thing for 18 days and one not for 21 days) will cure practically all cases.

DR RICHARD H HARTE said that the pain, intense rigidity, typical facial expression and the tendency to shock were so characteristic that the diagnosis of these perforations could, as a rule, be made without difficulty. Any attempt to deal with the conditions of shock was only a waste of time and the sooner operation was done the better would be the results.

He agreed with Dr Gibbon that in many of these cases the doing of a gastro-enterostomy was a waste of valuable time and should only be considered where the ulcer was too large to be closed in the usual way, and that in the majority of cases the results would be better if this method was pursued in the after-treatment, viz, restraining all food for a long period and, if necessary, nourishing the patient for the desired length of time by the rectum.

DR WILLIAM L RODMAN remarked that his experience had been very like Dr Deaver's in one respect, in at least two patients with perforation, one of the duodenum and one of the pylorus at the juncture with the duodenum where the perforation was large and the escape of contents free, indicating that ulceration had been going on for some time, in that there had not been a single symptom in either referable to the stomach. The last case operated on was a young boy working in an iron foundry, who was seized with cramps after partaking of a hearty lunch. He was operated on within two hours. The perforation was so large and escape of contents so free that pylorotomy seemed advisable. If the perforation is in the stomach then one may or may not do a posterior gastro-enterostomy. If in the duodenum and much infolding is necessary to accomplish the result, a posterior gastro-jejunostomy would seem indicated. He said he had lost but one case which was operated upon more than 48 hours after perforation. He had always believed when practicable in the radical

cision of the colon have become more generally known, much controversy over the rationale and efficiency of this operation has been occasioned. It would seem after carefully studying 50 cases reported by Chapple, which had been submitted to this operation, that it was only undertaken after all the more simple remedies had failed and after there had intervened phenomena which were more serious than simple constipation.

In the first case reported below the operation was not primarily undertaken to excise the colon, but this was found necessary owing to the serious interference with the blood supply of the bowel, which was occasioned by the separation of intra-abdominal adhesions. Anastomosis in this case was made between the ileum and the colon at the splenic flexure. A Finney's pyloroplasty was done at the same time. One of the most interesting results of this operation was the fact that a very intractable asthma, which had existed before it, seemed to be completely relieved and she seems now to be in perfect health.

The second case was operated on with the definite intention of excision of the colon. This patient suffered from abdominal pain, nausea and vomiting. Had a furred tongue, cold extremities, and extreme nervousness and marked emaciation. Palpation revealed a large mass extending from the right iliac fossa to the liver. Bismuth remained in the ascending colon for ten days after its ingestion. There had been no bowel movement for twelve days previous to entrance to the hospital. Even active purgative measures instituted before operation were ineffectual in emptying the bowel, as is evident on examination of the specimen. In this case the ileum was anastomosed to the sigmoid flexure after the intervening colon had been removed. Although this operation has been recent, the patient is already gaining daily in health and strength with marked improvement of appetite and is having two or three bowel movements every 24 hours owing to the short piece of large intestine remaining. The particular point to be avoided in the operation seemed to the writer to be keeping away from the duodenum on the transverse limb of the hepatic flexure. In neither case were breast changes noticed nor interference with the function of the joints, pigmentation of the skin, nor blood in the vomitus.

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enormously distended cæca had been left undisturbed, the bearers of which had been a constant source of annoyance to him because of their very vague pains remaining in the right iliac fossa, and other cases of ventral fixations, nephrorrhaphies and gastro-enterostomies in whom ptosed and dilated colons were observed at operation, in whom there had been but little abatement of symptoms or no improvement in general health. Three other cases were cited in which the speaker felt that an excision or exclusion of the colon would have markedly benefited.

One, operated on four years ago for appendicitis with much dilatation of the cæcum with but temporary improvement, who now complains of constant pains in the right iliac fossa, pale pasty complexion, cold clammy hands, anæmia and chronic infection of the ethmoid cells, in whom, although the bismuth was delayed in passage, there occurred daily movements.

The second case was operated on six years ago for appendectomy, right salpingo-oophorectomy and ventral fixation, who three days post-operative developed obstruction of the bowel and in whom on reoperation adhesions were found at the splenic flexure where the colon was almost occluded by adhesions not noted at the previous operation. Subsequent history developed the fact that evacuations had been effected only after four quarts of water had been administered by enema. The patient died.

A third in whom 18 months ago a Finney's pyloroplasty was done for the symptoms of eructations of gas, constant gastric distress, occasional vomiting and obstinate constipation. There was a large redundant colon noted, and, while there was an improvement in the gastric symptoms, constipation remains and her general condition is still poor.

The speaker further stated that such questions as abnormal fixations of the pylorus by adhesion bands (either evolutionary, as claimed by Lane, or inflammatory, as held by others), which also elevate the hepatic and splenic flexures and bind down the lower part of the sigmoid and the upper part of the rectum and cause various irregular fixations of the intestines, do not always involve facts capable of practical demonstration. The effects of intestinal absorption upon the various organs and upon metabolism in general are not so well comprehended as to enable us to attribute arterial sclerosis, breast changes, joint involvement, tuberculosis of the hip to colonic stasis, although some symptoms

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Dr Nassau recalled many cases of appendectomies which continued to suffer abdominal pain after operation, and cases in which

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are very suggestive. Certainly all the variations from normal are not necessarily pathologic. Certainly chronic constipation is a simple diagnosis and the signs of auto-intoxication unmistakable. Colonic redundancy or ptosis is definitely revealed by the skiagraph. It would seem that one might best plan operative interference by drawing their conclusions from the X-ray where there can be demonstrated an unmistakable mechanical obstruction. Certainly excision of the colon for this condition will become a permanent operation.

CASE I—G. C., thirty-eight years, has had all usual diseases of childhood. Operated on September 23, 1909, 29 stones removed from gall-bladder, appendectomy, transverse colon elevated and fixed. March, 1910, gall-bladder was removed for gangrene of gall-bladder.

*Present Illness*—Since last operation patient has had asthmatic attacks preceded by sneezing and a tickling sensation in the nose. The attacks usually occur at night. And are now occurring about every six days. A lump appears in the region of the gall-bladder, the attacks come on, the patient vomits a large quantity of bile and is then relieved. Sometimes the attacks are aborted by hot coffee. Formerly the bowel movements were light in color, but now they are of normal color. Bowels are constipated. During the attacks the patient voids frequently and large quantities. No pain. Appetite is fairly good.

*Operation* (December, 1910)—Patient etherized. An incision five inches long was made in the region of the gall-bladder through the old incision. The bowels were found to be adherent to each other in several places. Pylorus and duodenum were adherent to the under surface of the liver and to each other. The stomach was pulled to the right and was considerably ptosed. The colon and cæcum were distended. The cæcum was about three times the normal size. Transverse colon was ptosed. All adhesions were broken up. A Finney's pyloroplasty was then done.

Owing to destruction of blood supply it was decided to remove portion of colon. The transverse colon was clamped at about its centre, the mesocolon was dissected free from the rest of the transverse colon, ascending colon and cæcum, being clamped as it was dissected. The ileum was clamped about 4 inches from the cæcum and cut across. The mesocolon was ligated with heavy

duodenal ulcer It was a horseshoe ulcer an inch and a half in length, the primary perforation was close to the pylorus and the second at the other end Had he had a gastro-enterostomy he probably would not have perforated the second time, but it was not done, for the man was reported by the anæsthetist as dead on the table during the operation

DR JOHN B DEEVER, in closing, stated that in the majority of cases perforated ulcers were diagnosed by the house surgeon, who sees the patient first Dr Ross and others have said that certain cases of acute perforation are not diagnosable, this is doubtless true in a very small percentage, but not in the majority of cases by any means He had seen two perforated gall-bladders neither of which were diagnosed and in both of which he questioned if there was not a perforated duodenal ulcer

The majority of cases reported in his paper were very easily diagnosed by the definite character of the rigidity of the abdominal wall Liver dulness is to be considered, but the special point is pronounced rigidity There is difference of opinion as to the propriety of the performance of posterior gastro-enterostomy, he did gastro-enterostomy in practically all cases and sees no reason why it should not be done He did not think there was anything to be lost in opening up the lesser peritoneal cavity, the latter could only be so when the patient had advanced peritonitis, and then nothing would do him any good In the case of the patient upon whom both Dr Wharton and he operated the indurated area of the duodenum was the size of a silver dollar The question of pylorotomy should be considered, but unfortunately in many of these cases the indurated area is in such close proximity to the head of the pancreas as to forbid it

Regarding feeding of the patient after operation, he concurred with Dr Gibbon, he had frequently kept patients for ten days without any nourishment except that received through the bowel by means of enteroclysis containing whiskey and predigested beef juice After the patient had recovered from the surgical treatment he should be treated medically

#### EXCISION OF THE COLON

DR CHARLES F NASSAU read a paper with the above title, prefacing the report of two cases by remarking that since the communications from Mr W Arbuthnot Lane regarding ex-



a degree but not *in toto* He did not believe all these cases of pain which Dr Nassau's and his patients had after operation require further operative interference, nor did he believe by any means that all of them were due to chronic intestinal stasis. The case shown Dr Nassau was undoubtedly such a one He did not see how any medication or massage would aid that condition He had had the pleasure of having Mr Lane operate on a case for him at the University Hospital, in which he divided the lower ileum and anastomosed it to the side of the sigmoid flexure low down

### SACRO-ILIAC SUBLUXATION

DR JOHN B ROBERTS reported the case of a man aged twenty-one years who was admitted to the Methodist Hospital October 31, 1912, with the history that the previous night he had been caught between a moving freight car and a cap log He complained of pain in the back, the epigastric region and the right hip There was tenderness over the right hip, but by passive and active motion of the right lower extremity no clinical evidence of fracture of the femur or dislocation of the hip-joint was found When he first entered the hospital his condition was not thought to be serious, and his injuries were looked upon as mere contusions He was, accordingly, referred to the dispensary by the resident physician, but was brought back to the hospital on account of pain, entering, as above stated, on the 31st of the month His temperature was 100°, pulse 90, respirations 24 He was not seen by the speaker until the next day, which was November 1

The X-ray report by Dr Percival showed that the man was suffering from a subluxation of the right sacro-iliac articulation, which was shown by an irregular line running in a generally vertical direction between the sacrum and ilium The man complained of a good deal of pain Broad bands of adhesive plaster were applied around the pelvis so as to steady it This strapping extended from the pubes to the umbilicus and was carried over the bony prominences of the ilium, which were protected by cotton pads The urine was negative

On the 8th of the month ether was administered and a more careful examination made before attempting reduction of the displacement The legs, measured from the anterior superior spine

of the ilium to the lower part of the internal malleolus, were apparently of the same length. Posteriorly a line, drawn transversely across the back between the posterior superior spines of the ilium, showed that the distance from the middle of the spinous processes of the vertebræ to the posterior iliac spine was slightly greater on the right side, which was the injured side, than on the left. The examination of the length of the limbs, etc., and the skiagraph showed no fracture of the iliac bones, and the pubic arch and the ischium were free from such injury. Under full relaxation of ether with two men making traction upon the axillæ and shoulders and a third making steady pull on the right limb by grasping him by the foot and ankle, the speaker was able, with his hand upon the posterior portion of the right iliac bone, to cause by manipulation a sudden slipping similar to that which is felt when dislocation is reduced in other regions. The slip was not like the grating of crepitus in broken bone, nor quite so marked as the snap which is felt in reducing a ball and socket joint, but it, however, partook more of that character than of the character of joint crepitus from arthritis or a fracture crepitus from broken fragments.

A large plaster-of-Paris and gauze splint was made by pouring the gypsum paste upon large sheets of gauze laid one upon another. This was fitted to the whole back and held in front so as to make a great trough in which the body lay. This splint was held in place by a many-tailed Scultetus binder.

An X-ray picture taken subsequently showed, according to Dr. M. F. Percival, the radiographer, a more nearly normal relation of the parts than before the reduction operation was attempted. The gypsum trough was removed at the end of about two weeks. The injured region was then supported by adhesive plaster strapping.

On November 29 the patient was allowed to be up in a chair as the pain and tenderness were not so marked.

On December 2 he was ordered to use crutches, which he refused to do, either from pain, or because of his sullen temperament.

On December 5 he was discharged, as he was unwilling to remain any longer. During a display of anger at this time he attempted to walk and did so, though with difficulty. This, according to the resident physician's record, seemed to be due more

to the inactivity of lying in bed than from any great pain suffered. It is difficult to know how much pain the man really had and how much was assumed.

This case is reported because from a hasty glance at the textbooks on dislocation one realizes that sublaxations of this joint must be unusual, as it is difficult to find records of them. In this instance it seemed that there was no fracture, but a true displacement to a limited extent of the joint surfaces. There is usually an articular cavity between the sacrum and ilium, although there is often an obliteration of the cavity more or less complete by fibrous union between the cartilages.

A good deal of attention has recently been given to this joint because of the opinions of some orthopædic surgeons that many painful injuries of the back are undiagnosed partial displacements or sprains of this articulation. It hardly seems possible that sublaxations are as frequent as some writers seem to insist. X-ray investigation and reports of injuries, such as that just described, should, therefore, be recorded. Thus the true pathology of the lumbar pains discussed by Goldthwait and others will become more thoroughly understood.

DR ASTLEY P. C. ASHHURST stated that he had recognized only two undoubted cases of sacro-iliac sublaxation. The first patient was a young woman who sprained her back by carrying a heavy hand-organ around the streets in her occupation as "mission singer." She had been ailing for months and could get no relief. Then she came under the speaker's care in Dr. Davis's service at the Orthopædic Hospital about six months ago. She was put through the routine examination for sacro-iliac sprain, and though no luxation was recognized at the time, she reported at her next visit that ever since having the "manipulations" she had been free from all discomfort. She has remained well since.

About the same time a man hobbled into the dispensary at the Episcopal Hospital, he was bent over and could hardly walk. He had injured his back by a lifting strain, and had been confined to bed, in constant severe pain, for about a week. He was placed upon the bed for examination with difficulty, and made to lie prone. After the routine examination he got up from the bed quite spryly, walked around the room in comfort, and expressed his delight at the rapid cure.

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY.

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*Stated Meeting held at the Roosevelt Hospital, January 22, 1913*

The President, DR CHARLES L. GIBSON, in the Chair

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### COMPRESSED AIR FOR OPERATING-ROOM AND EMERGENCY USE

DR KARL CONNELL (by invitation) demonstrated an apparatus forming part of the equipment of the Roosevelt Hospital, by which compressed air was supplied from a central plant for delivering anæsthetics and for emergency use. He stated that after careful investigation, it had been found that the cheapest, most stable and reliable compressor for the service desired was the reciprocating steam pump. Rotary mechanism was eliminated from consideration on account of the waste and wear and unreliability of high speed machinery, while electric pumps were eliminated on account of the greater first cost, the less direct and more expensive form of energy used, but chiefly on account of the lack of reliability. Steam pumps, on the other hand, were cheap at first cost and cheap maintenance in energy consumed.

In conjunction with the air supply, Dr Connell also demonstrated the permanently installed low pressure supply of nitrous oxide and oxygen, of which only the supply cocks and pressure gauges showed in the operating room.

Dr Connell further demonstrated an anæsthetic meter for automatically delivering exact amounts and percentages of ether vapor, air, and exact mixtures and quantity of two or more anæsthetic gases.

### PERFORATED DUODENAL ULCER

DR KARL CONNELL presented a man, thirty-two years old, who was admitted to the Roosevelt Hospital on January 7, 1913. For twelve years, periodically, he had suffered from indigestion, with anorexia and eructations of acid food. For four years he

had had attacks of epigastric pain, coming on usually three hours after the evening meal, and relieved by food and beer. After his Christmas dinner, he suddenly experienced a cramp-like pain in the epigastrium. This was relieved by vomiting, but persisted with lesser severity until New Year's Day, when, after another hearty meal, he experienced a similar and more severe attack, and was subsequently confined to bed with general abdominal pain localized in the right upper quadrant.

On admission, there was generalized rigidity and tenderness in the right upper quadrant. He had a slight rise of temperature, and a blood count showed a moderate leucocytosis. The abdomen was opened through a right rectus incision, and a small abscess was found between the stomach and the anterior abdominal wall, with a perforation on the anterior face of the pylorus, distal to the pyloric ring, and sealed by omentum. The ulcer was inverted by suture, a posterior gastro-enterostomy was done and the wound closed, with drainage over the site of the abscess.

Cultures from the abscess showed a non-hæmolyzing streptococcus of low virulence and in pure culture.

Two hours after the operation, symptoms of acute gastric dilatation presented, these were relieved by prompt lavage and turning the patient on his face. The post-operative course was otherwise without unusual incident.

#### ACUTE SUPPURATIVE OSTEOMYELITIS OF THE SCAPULA.

DR JAMES I RUSSELL presented a girl, ten years old, who was admitted to the Roosevelt Hospital, in the service of Dr George E. Brewer, on January 4, 1913. The history obtained was that five weeks prior to her admission she began to suffer from pain, swelling and stiffness of the right shoulder, and at that time she felt ill and feverish. The fever and pain gradually subsided, but the stiffness and swelling persisted and the difficulty in moving the arm gradually increased.

When the patient entered the hospital, abduction was limited to about 45 degrees, flexion and extension to about 50 degrees. The contour of the right scapula was obliterated and there was an area of fluctuation over the suprascapular fossa from which the staphylococcus aureus was obtained by aspiration and at the time of operation, as shown by culture. There was no history

of a previous injury. The patient had had measles, mumps, whooping-cough and tonsillitis, but none of these illnesses immediately preceded the present condition. An examination of the blood showed 15,800 leucocytes, 4,000,000 red blood cells, 75 per cent. hæmoglobin, and 65 per cent. polynuclears. The Von Pirquet and Wassermann tests were negative; the urine showed nothing abnormal.

An operation revealed pockets of pus burrowing through the supraspinous fossa, extending along the posterior border of the scapula through the spine, involving the infrascapular fossa and the lower angle of the bone. The cavity thus formed was lined with soft granulation tissue containing several sequestra. The granulations were scooped out, the cavity swabbed with carbolic acid and alcohol and then filled with Mosetig-Moorhof paste. The case was progressing favorably, and the patient was still under treatment in the hospital.

#### PAPILLARY CYSTADENOMA OF THE MALE MAMMARY GLAND

DR. RUSSELL presented a man, fifty-six years old, who four months prior to his admission to the hospital noticed a small, hard, painless lump in the left breast. This had gradually increased in size until it was as large as a small orange, involving the entire breast, which was tender and fluctuating at the nipple, the surrounding area being hard and nodular and not tender to palpation. The skin was adherent at the nipple and the entire mass moved on the deep fascia. There were no palpable axillary glands. The patient could recall no injury to the breast, he did not think that he had lost weight, but was not as strong as he was a year ago. He had suffered from a slight cough during the past year, but was otherwise well. There had been no secretion or bloody discharge from the nipple.

A complete removal of the breast was done. Pathologically, the growth proved to be a papillary cystadenoma.

#### STRANGULATED FEMORAL HERNIA PARTIAL ENTERECTOMY

DR. RUSSELL presented a woman of sixty who was admitted to the hospital on November 26, 1912. For four years she had had a right femoral hernia which she had been able to control

had had attacks of epigastric pain, coming on usually three hours after the evening meal, and relieved by food and beer. After his Christmas dinner, he suddenly experienced a cramp-like pain in the epigastrium. This was relieved by vomiting, but persisted with lesser severity until New Year's Day, when, after another hearty meal, he experienced a similar and more severe attack, and was subsequently confined to bed with general abdominal pain localized in the right upper quadrant.

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#### PAPILLARY CYSTADENOMA OF THE MALE MAMMARY GLAND

DR. RUSSELL presented a man, fifty-six years old, who four months prior to his admission to the hospital noticed a small, hard, painless lump in the left breast. This had gradually increased in size until it was as large as a small orange, involving the entire breast, which was tender and fluctuating at the nipple, the surrounding area being hard and nodular and not tender to palpation The skin was adherent at the nipple and the entire mass moved on the deep fascia There were no palpable axillary glands The patient could recall no injury to the breast, he did not think that he had lost weight, but was not as strong as he was a year ago He had suffered from a slight cough during the past year, but was otherwise well There had been no secretion or bloody discharge from the nipple

A complete removal of the breast was done Pathologically, the growth proved to be a papillary cystadenoma

#### STRANGULATED FEMORAL HERNIA PARTIAL ENTERECTOMY

DR RUSSELL presented a woman of sixty who was admitted to the hospital on November 26, 1912 For four years she had had a right femoral hernia which she had been able to control



by a truss Three hours before admission she was seized with cramp-like abdominal pain and vomiting, and found that she could not reduce the hernia Upon admission, her temperature was  $102^{\circ}$ , pulse, 92, leucocytes, 12,400, polynuclears, 87 per cent

Operation, which was done by Dr Russell about six hours after the onset of the symptoms, revealed a gangrenous loop of intestine, necessitating a resection of 8 or 10 inches of intestine, which was done by an end-to-end suture through a right rectus incision The patient's convalescence was uneventful until the eighteenth day, when she developed a right lobar pneumonia, from which she made a good recovery

In connection with this case, Dr Russell called attention to the advantage of an incision through the right lower rectus muscle in dealing with a femoral hernia in which a resection was necessary

#### ACUTE UNILATERAL HÆMATOGENOUS INFECTION OF THE KIDNEY NEPHRECTOMY

DR RUSSELL presented a man, twenty-three years old, who was admitted to the hospital on December 27, 1912, with the history that eighteen hours before his admission he was seized with a sharp pain in the right lumbar region He felt nauseated, but did not vomit There was frequent, burning urination On admission, his temperature was  $101.6^{\circ}$ , pulse, 84 A blood count showed 14,000 leucocytes, 67 per cent of polynuclears and 33 per cent lymphocytes There was tenderness over the right kidney, the lower pole of which was palpable

Eight hours after his admission, the temperature had risen to  $104.4^{\circ}$ , and it ranged between this and  $103^{\circ}$  for 48 hours It fell to normal on the third day, and upon cystoscopic examination pus and red blood cells were observed coming from the right kidney The left showed nothing abnormal His temperature, with the exception of one sharp rise, remained practically normal for six days and then suddenly rose to  $103.8^{\circ}$ , where it remained for twenty-four hours, when the right kidney was removed The patient's convalescence was complicated by a severe bronchitis, but was otherwise smooth The urine, which contained much pus and some red blood cells before the operation, still contained a trace of pus, but no blood cells

## URETEROLITHOTOMY

DR WILLIAM DARRACH presented an iron-worker, thirty-one years old, who nine months before his admission to the Roosevelt Hospital began to suffer from daily attacks of hæmaturia. About a month after their onset he had a sharp attack of pain in the left lumbar region, followed by the passage of gravel and a subsidence of the pain. During the next two months the hæmaturia persisted, but without pain. About four months ago the pain recurred in the left lower quadrant and left kidney region, the attacks usually coming on at night, preventing sleep, and associated with burning urination. Occasionally, the pain radiated downward to the head of the penis. Since that time there had been no hæmaturia, but a persistent pain in the left lumbar region.

A physical examination at the time of the patient's admission to the hospital was negative. Upon cystoscopic examination, the urine from the bladder was found to be slightly turbid. There was some congestion of the bladder walls, but the bladder tolerance was good. The right ureteral orifice was normal, and a catheter was passed to a point 23 cm from the bladder wall, where it was obstructed. From this catheter there was an immediate and rapid flow of urine, which was clear in its gross appearance. Indigo-carmin did not appear in the flow within thirty-five minutes after its injection, showing that the function of the kidney was evidently below par. The left ureteral orifice was large and somewhat congested, and the catheter became obstructed after passing it for a distance of nine cm. Pressure at this point produced pain, which was referred to the head of the penis. No urine was secreted through the catheter, and movements of the instrument within the ureter were followed by the discharge of a small number of pus flakes.

*Operation* (August 31, 1911) —An incision was made from the tip of the twelfth rib downward and forward toward the anterior, superior spine. Upon incising the muscles and exposing the kidney, the latter seemed to be enlarged and was studded with white spots. The ureter was large and distended. With the fingers, the kidney capsule was freed from adhesions, but owing to its short pedicle it was impossible to deliver the kidney into the wound. The ureter was now freed with the

fingers, and a stone felt just at the pelvic brim. The stone was milked upwards until it could be reached through the wound. A half-inch incision was then made into the ureter longitudinally directly over the stone, and the latter removed with forceps. The calculus was about one cm in length. There was a considerable discharge of urine through the wound in the ureter. A flexible director was introduced, but no more stones could be detected. The incision in the ureter was closed with fine chromic gut, the wound was irrigated and a cigarette drain inserted to the kidney bed. The muscles were sutured with heavy chromic gut and the skin with silkworm gut. The cigarette drain was removed on the sixth day, and when the patient left the hospital, on the twenty-second day, the wound had completely healed. Since that time, over sixteen months ago, he had been free from pain and discomfort, and there had been no hæmaturia.

Dr Darrah said he had spared the kidney in this case because it seemed to be chiefly hydronephrotic, and because the function of the other kidney was somewhat impaired. The upper route was followed on account of the importance of inspecting the kidney itself.

#### CARCINOMA OF THE STOMACH PARTIAL GASTRECTOMY PULMONARY THROMBOSIS ABSCESS OF THE LUNG

DR DARRACH presented a stableman, thirty-two years old, who until nine months prior to his admission to the Roosevelt Hospital had enjoyed unusually good digestion. He then had a sudden attack of vomiting which recurred once or twice daily, and was at first associated with considerable abdominal pain, but later with almost no discomfort. More recently he had vomited almost everything he had eaten, the vomiting usually occurring two or three hours after meals, although some times not until the following morning. He had never vomited blood nor had he noticed that his stools were abnormal in color. In spite of the fact that his appetite remained good, he had lost 25 pounds in weight and felt very weak.

Upon admission, beyond marked emaciation and scattered palpable lymph nodes, the physical examination was negative,

except for the abdomen. This was slightly distended, the superficial veins being visible. The left upper quadrant seemed fuller than normal, and the liver edge could be felt just below the costal margin. Gastric peristalsis could be seen on tapping the abdominal wall, the greater curvature being outlined about the level of the umbilicus. A blood examination showed 5,090,000 red cells, with 52 per cent. of hæmoglobin, 8,000 leucocytes and 68 per cent of polymorphonuclears. Gastric analysis showed in a total amount of 60 c c, a total acidity of 12, with no free hydrochloric acid, a questionable lactic acid reaction and no blood.

Upon operation, a mass was found on the lesser curvature of the stomach near the pylorus, involving both the anterior and posterior surfaces. A little more than the distal half of the stomach was removed, and a posterior gastrojejunostomy was done. Pathologically, the growth was pronounced an adenocarcinoma of the stomach, with lymph node metastases.

On the second day after the operation, the patient's temperature rose to  $102^{\circ}$ , falling to normal on the fourth day. On the eleventh day, after a sudden attack of pain in the left infra-scapular region, the temperature again began to rise, and examination of the chest showed an area two and a half inches in diameter which gave bronchial voice and breathing sounds, with crepitant râles. The temperature reached  $102^{\circ}$  on the fourteenth day and then ran an irregular course for two weeks, ranging between normal and  $103^{\circ}$ . The sputum gradually became more profuse and very foul-smelling, containing many pus cells and cocci, no tubercle bacilli were found.

When the patient left the hospital he had a troublesome cough, with foul-smelling expectoration, which was very profuse on rising. He was sent to the day camp on the roof of the Vanderbilt Clinic, where his cough and expectoration gradually cleared up, and within three and a half months he had gained over 20 pounds.

At the present time he had no digestive symptoms of any kind excepting a sense of fulness after a large meal. His appetite was excellent. There was still a slight cough, especially in the morning, but with little or no expectoration. He is now  $14\frac{1}{2}$  pounds over his normal weight.

PARTIAL EXCISION OF LOWER SHAFT OF ULNA FOR  
DEFORMITY FOLLOWING COLLES'S FRACTURE

DR DARRACH presented a waiter, thirty-eight years old, who seven weeks before his admission to the hospital fell, striking on the dorsum of the flexed wrist and sustaining a fracture of the lower extremity of the radius. He was treated by splints for four weeks, followed by massage and baking. At the end of six weeks, both pronation and supination were limited to one-half, there was flexion to 135 degrees, extension to 200 degrees, normal abduction and no adduction. Attempts at supination and adduction caused pain. The X-ray showed marked comminution of the lower radius, with considerable radial shifting. The lower extremity of the ulna was below the level of the radial articular surface.

Because of the good results obtained after the subperiosteal removal of the lower extremity of the ulna in an old, unreduced forward dislocation of the head of the ulna, it was thought that the condition in this case might be improved by a similar procedure. The pain and limitation of function were believed to be due to the relatively lower position of the ulnar head, and the resulting strain on the inferior radio-ulnar and radio-carpal articulations. As it seemed unwise to try to lower the radial articular surface, it was decided, at the suggestion of Dr Kirby Dwight, to shorten the ulna, preserving the ulnar articular surface.

Through a small posterior incision the lower end of the ulna was exposed, its periosteum carefully reflected and about half an inch of the shaft removed. The bone was cut through with cutting forceps, resulting in a good deal of splintering, an effort thus being made to obtain a more rapid regeneration. The hand and forearm were put up in a starch bandage in strong adduction and left in that position for five weeks, the first dressing being done at the end of two weeks. At the end of seven weeks supination and pronation were limited to one-fifth. There was flexion to 135 degrees and extension to 225 degrees, with twenty-five degrees of adduction. There was no pain on extreme supination, but slight pain on extreme pronation still persisted. There was still slight motion at the site of the fracture.

Dr Darrach said that this operation seemed indicated in old

cases of fracture of the lower extremity of the radius where, through impaction or comminution, the level of the radial articular surface was sufficiently raised above the level of the ulnar head so as to interfere with the movements of pronation, supination and adduction. When there was much radial shifting it would seem wiser to remove the whole lower three-fourths of an inch of the ulna, not including the styloid process, as the speaker said he did in a previous case of old, unreduced forward dislocation of the head of the ulna. That case was already on record.

DR CHARLES A ELSBERG said he could recall several cases where he had met with considerable difficulty in getting union in the ulna. In one instance it was two years before satisfactory union of the bone occurred.

DR DARRACH said that in two out of three cases of partial ostectomy of the ulna that he had performed, solid union had taken place without much difficulty, but that there still existed in the present case a little motion at the site of the operation.

#### PARTIAL ENTERECTOMY FOR INTUSSUSCEPTION IN A CHILD FIVE DAYS OLD

DR CHARLES N DOWD presented this case with remarks, for which see page 713.

#### DIVERTICULITIS ILLUSTRATING THE LIMITATIONS OF THE TWO-STAGE METHOD OF PARTIAL COLECTOMY

DR DOWD presented a man, sixty-four years old, who was operated upon in the Roosevelt Hospital in June, 1912, for a left scrotal hernia of the so-called "sliding" variety. It was not possible to adjust a satisfactory mesocolon for the displaced intestine, although this intestine was returned to the abdomen in fairly good condition and was only slightly constricted by later adhesions.

In September, 1912, the patient returned to the hospital suffering from attacks of constipation and from pain in the left side of the abdomen, where a large mass could be felt. An incision was made through the left side of the abdominal wall, and the mass was found to be connected with the descending

colon Subsequently, it was found to be due to an intestinal perforation caused by diverticulitis, the intestinal contents had escaped into the peri-intestinal fat, and had formed an encapsulated abscess which was connected with the intestinal lumen by a small channel This fatty tissue was very extensively indurated, and was thoroughly incorporated with the intestinal wall The mass was six or eight inches in diameter, and was only slightly movable In appearance it suggested carcinoma, and manifestly a resection was necessary whether the condition was due to carcinoma or to diverticulitis The peritoneum was therefore divided at the left of the descending colon, thus mobilizing that portion of the intestine and the indurated fat in which it was encased. The entire mass was then delivered through the abdominal incision The afferent and efferent portions of the intestine were clamped, their walls were sewn together internal to the clamps for a distance of three or four inches, and the abdominal incision was closed up to the point of their emergence A silk ligature then replaced the clamps which closed the emerging intestine, and the entire mass was removed, leaving the afferent and efferent portions of intestine projecting from the wound, somewhat after the manner of a double-barrelled gun

The silk ligatures were left in place for 72 hours, which was much longer than the observer had supposed possible By that time good wound healing had resulted, and a satisfactory artificial anus was established The partition between the two portions of intestine was included in a pressure clamp after the method of Krause<sup>1</sup> This pressure was begun on the fifth day, and the opening was complete on the seventh day Fecal matter then passed to the anus, but as there was still much leakage by the stoma, the rest of the partition was included in a clamp and similarly divided An attempt to close the stoma under cocaine was only partially successful

Owing to absence from the city, further treatment was delayed until November, when under ether anæsthesia the intestinal margins were liberated and the edges freshened and brought together They were then reinforced by a second row of stitches

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<sup>1</sup> Krause Cent Chir, 1900, 57

and further supported by a row of skin sutures. Healing promptly resulted, and the patient had enjoyed excellent health since.

Dr. Dowd said that the method of lateral anastomosis with immediate wound closure after intestinal resection had been very widely adopted. It presented many advantages, and any one who employed a different method might well be expected to give his reasons for doing so. The first reason must be that patients with cancer of the large intestine were usually very poor surgical risks, most of them are much debilitated by their disease and many are in a condition of acute obstruction when they come to the hospital. The mortality rate of resection and immediate anastomosis must be very high in debilitated patients who have large amounts of retained intestinal contents.

Again, much peri-intestinal inflammation may be present, owing to perforation from diverticulitis or ulceration, and such inflammation greatly increases the difficulty of successful anastomosis.

Again, there is sometimes a great deal of fat about the wall of the large intestine; this lies between the peritoneum and the muscular coat of the intestine, and increases the difficulty of getting peritoneal apposition.

Mikulicz studied these conditions with much care, and by adopting a two-stage operation for cancer of the large intestine reduced his mortality rate from 43 per cent to  $12\frac{1}{2}$  per cent. Bier, Braun and Kummel, in their System of Operative Surgery, have devoted twelve pages to the consideration of the two-stage method of resection of the large intestine. In von Bergman's system this method is given as the operation of choice for the large intestine. Any one who has had the very disagreeable experience of treating one of these patients with an artificial anus will avoid the method if possible, but without doubt it is a life saving procedure in certain instances.

The following details of technic may be mentioned. 1 The afferent and efferent portions of intestine should be joined by a running catgut suture for three or four inches, thus providing a septum which is to be divided at a later date. 2 A pressure clamp should be applied as soon as practicable. Many such



clamps had been devised Dupuytren's, which was the pioneer, was a very good one. An ordinary, long-jawed clamp does excellently. The handles may be filed off, and the remaining shank included in an ordinary rubber band so as to secure pressure. 3 The temporary closing of the intestinal ends in ligatures is an advantage. If these ligatures can be left on 24 to 72 hours, they prevent intestinal leakage and hence do much to secure wound healing. It is an application of the same principle which Dr Charles H. Peck has used in resection of the rectum.

### PERICARDOTOMY FOR HEMORRHAGIC PERICARDITIS

DR CHARLES N. DOWD said that in the past there had been numerous cases of adherent pericardium in St. Mary's Free Hospital for Children. Dr. George M. Swift, who had had these patients in charge, published an article on the subject in the *Medical News*, February 28, 1903. At that time there had been eighteen cases, the patients giving symptoms of advanced cardiac disease, hypertrophy, regurgitation, dilatation, and, finally, failure of compensation. These cases were uniformly fatal. There had been autopsies on many of them, and the heart was found to be enormously dilated, the pericardial sac was obliterated by adhesions between the pericardium and the heart wall, there were also adhesions between the pericardium and the lung and mediastinum.

Since the publication of Dr. Swift's paper there had been a succession of similar cases in the hospital, and they had been on the lookout for a case where an operation might be of some value. The case shown to-night was the first one that had seemed suitable for operation, and the patient was not presented as a cured case, but as a slight contribution to the subject.

The patient was a boy, six years old. Early in October, 1912, he became ill with symptoms of pneumonia. When he was brought to the hospital, about November 1, there was an increased area of cardiac dulness, with pericardial friction sounds. The heart sounds were normal, but impaired. The X-ray showed very large pericardial sac. The edge of the liver was one inch

below the free border of the ribs. The boy failed to improve under ordinary treatment and an operation was finally decided upon in the hope of relieving the pericardium from its contents.

At the time of the operation, which was done on December 6, 1912, the liver edge extended three inches below the free border of the ribs. The operation was done under intra-pharyngeal insufflation anæsthesia administered by Dr. Karl Connell. An incision was made from the middle of the sternum down to the xiphoid cartilage, and a flap turned to the left. The fifth and sixth costal cartilages were removed for an inch and a half to the left of the sternum, together with a small piece of the sternal edge. This gave an exposure of the pericardial sac for an area of about one by one and a quarter inches. On endeavoring to extend this area to the left, a small opening was made through the pleura which was quickly closed by a catgut stitch. An aspirating needle was then inserted through the pericardium, and blood was withdrawn. Blood also oozed through the hole which the needle had made, and a similar result followed the introduction of other aspirating needles. An incision was then made through the pericardium, which was found to be thickened, and there was considerable material of a loose, spongy texture on its inner surface. A probe was inserted, this entered a large cavity and the heart beat could be felt against it. The incision was then enlarged, and a finger inserted, coming in contact with a spongy material which seemed like coagulated blood. Blood oozed through the opening in large amounts, it was thin and dark, and had the appearance of old blood which had been in the sac for a long time. Several ounces of this material were removed, and it spurted through the incision with each pulsation of the heart. At last this flow ceased, and the heart seemed to be in contact with the pericardial wall. During a part of these manipulations the child's pulse was considerably above 200, and very weak, but it gradually increased in force and was stronger when he was taken from the table. On the following day he was still weak, but made a good operative recovery. The liver, which had been below the free border of the ribs, was retracted to that border. An X-ray, however, taken a few days later, showed that the cardiac area had not diminished as much as had

been expected, and the child, in the meantime, had not gained satisfactorily in strength

Dr Dowd said he expected to do another operation in this case, in the hope of more radically relieving the pericardial contents. At the time of the first operation he believed that the pericardial sac was empty, but he now thought that clots or a reaccumulation of fluid must be present. He naturally had not felt like exploring to an indefinite degree the interior of the pericardial sac of a very weak child, from which blood had just been spurting in large amounts. He did not drain the sac because he thought the danger of introducing sepsis would more than counterbalance the possibility of resulting benefit.

Dr Dowd said he had found very little in the literature about hemorrhagic pericarditis. Most of the operations on the pericardium had been done for purulent pericarditis, hence there was little about the type of case here described. The references to pericarditis indicated that it was usually caused by a malignant disease or tuberculosis, or by a hemorrhagic tendency similar to that found in purpura hemorrhages. The best suggestion that one could offer for this case was that the boy had a serous pericarditis, and that it was accompanied by an effusion of blood, just as such an effusion may be found in the joints of patients who have purpuric hemorrhages. There was, however, no other indication of a hemorrhagic tendency in this child. The X-ray indicates that the thymus is enlarged.

#### PERINEPHRITIC ABSCESS OF INTESTINAL ORIGIN

DR CHARLES H. PECK presented a Russian tailor, forty-eight years old, who was admitted to the Roosevelt Hospital on December 2, 1912, complaining of pain in the left flank. This was of uncertain duration, with a recent exacerbation dating from an attack of constipation. The presence of a renal or ureteral calculus was suspected, but cystoscopy, radiographs and urinary examinations were all negative, and there were no bladder symptoms. As the patient had no fever, and no surgical lesion could be detected, he was transferred to the medical division and kept under observation until January 13, 1913, when he was re-ad-

mitted to the surgical service. In the meantime, his temperature, which had been elevated, had gradually fallen to normal, the pain had abated, and for about ten days he seemed to be getting well. Then his pain recurred and persisted, and the temperature gradually rose to  $103^{\circ}$ . The only local symptom was tenderness in the left flank

Upon operation, which was done on January 14, a chronic, well defined suppurating tract was found in the perirenal fat, its upper extremity reaching nearly to the 12th rib. On cutting through its anterior lining wall, the fat immediately surrounding the kidney, as well as the kidney itself, seemed perfectly normal. Traced downward, the tract extended towards the pelvis, becoming somewhat larger in its lower part. On lightly curetting the lower end of the tract, a small amount of fecal matter was recognized. No attempt was made to identify the portion of the gut communicating with the tract, on account of the inaccessibility of the perforation. It was probably the lower sigmoid or upper rectum. Wrapped tube drains were placed in the lower end of the wound, the remainder of which was closed. A fecal fistula had subsequently developed in the drainage tract.

Dr. Peck said the condition probably originated in the perforation of a small diverticulum, with the formation of a retroperitoneal abscess. The chronicity of the case would suggest that drainage into the intestine must have afforded partial relief from time to time, the slow extension upward in the perirenal fat having occurred when this drainage was blocked.

#### CHRONIC ULCER OF THE LESSER CURVATURE OF THE STOMACH

DR. PECK presented a man, forty-eight years old, who was referred to the Second Surgical Division of the Roosevelt Hospital on December 12, 1912, by Dr. William G. Lyle, who had observed him at irregular intervals for about two years. For six or eight years the patient had complained of pain in the epigastrium, constant and scratching in character, which was not relieved by vomiting nor by taking food, and which occurred irrespective of meals.

An examination of the gastric contents showed free hydrochloric acid, 60, with a total acidity of 78, no blood. Bismuth radiographs showed no evidence of stasis and nothing definite to aid in the diagnosis. The patient was kept under observation in the ward for nine days, when, on account of the persistence of the pain, which was apparently severe enough to disable him, an exploration was decided upon.

On operation, which was done on December 21, 1912, a callous, saddle-shaped ulcer of the lesser curvature of the stomach was found, about three inches from the pylorus. It was excised, together with a V-shaped segment of the lesser curvature and the anterior and posterior stomach walls, and the defect carefully sutured with two tiers of linen sutures.

The pylorus and duodenum and the remainder of the stomach were normal, and as the line of suture did not seem likely to cause obstruction, a gastro-enterostomy was not done.

The patient's convalescence was uneventful up to about the twentieth day, when, after eating a rather heavy meal, he vomited once and had some gastric disturbance. A temporary return to liquid diet relieved the symptoms. The patient was still under observation.

#### CARCINOMA OF THE RECTUM TWO-STAGE OPERATION PERMANENT COLOSTOMY

DR PECK presented a man, sixty-nine years old, who was admitted to the Roosevelt Hospital on October 10, 1912, with a large, ulcerated carcinoma of the rectum, about three inches from the anus. The growth was somewhat adherent posteriorly and had evidently infiltrated the perirectal tissue. He had had repeated small hemorrhages during the past eight months, with emaciation and loss of strength, and with gradually increasing symptoms of obstruction. Although an examination of the blood showed 85 per cent of hæmoglobin with 5,000,000 red cells, his appearance indicated a marked degree of cachexia and extreme weakness.

After careful consideration, a two-stage operation, with permanent colostomy, was decided upon, as this method seemed best

sued to the advanced local condition and the site of the growth, which precluded the possibility of preserving the sphincter. The extremely weak and unfavorable condition of the patient also led to this determination.

An exploration through the left rectus, which was performed on October 12, 1912, showed that there were no metastases in the liver or elsewhere in the abdomen, and no higher glandular involvement. A loop of sigmoid was stitched into the lower angle of the wound and opened three days later with the cautery, a complete spur being formed. On November 16, excision of the rectum was performed by the posterior route, after excision of the coccyx, the entire anal segment and sphincter being removed. The sacral glands and perirectal fat in the hollow of the sacrum were removed, several of the glands being involved, and the fat showing much inflammatory infiltration. The rectum was divided as high up as possible, its proximal end being carefully closed by a purse-string suture and two tiers of linen Lembert sutures, leaving a short, blind pouch distal to the colostomy. The attempt to keep the field aseptic failed, as the growth had ulcerated through the rectal wall, and leakage had occurred during the manipulation. Free drainage was employed, and there was a good deal of sloughing and discharge during the healing. His convalescence was slow, but during the past month he had shown marked improvement in his condition and had gained about five pounds in weight.

Dr. Peck said that an interesting condition had been noted in the blind pouch of gut distal to the colostomy. The spur was complete, and no fecal matter could pass from the proximal to the distal loop. The speaker said he was much surprised, therefore, when, about five weeks after the operation, a discharge of fecal matter through the posterior drainage tract was reported. A finger passed into the distal pouch from the colostomy opening showed a large mass of solid fecal matter in the blind pouch, and a perforation of the closed end, with discharge of some of the fecal matter into the drainage tract. This fecal matter had evidently formed in this completely isolated segment of gut. The possibility of such formation in completely isolated segments of colon was demonstrated by Dr. Joseph A. Blake in studies on

intestinal exclusion in dogs some years ago This was the first time, Dr Peck said, that he had had the opportunity to observe it in the human subject

The selection of the best method suited to meet conditions in each case of carcinoma of the rectum was a matter of great importance The procedure employed in this case had been much used in England and Scotland, and to some extent at the Mayo clinic, and was indicated for debilitated patients with fairly advanced growths in whom the one-stage operation, especially by the combined method, would seem too great an operative risk

DR HENRY H M LYLE said he recalled one case where about a year after the operation the patient returned, and upon examination it was found that the segment of the gut, which had been tied off and isolated, had developed into a large mucocyst occupying the whole pelvis The removal of this cystic gut entailed considerable difficulty

DR CLARENCE A MCWILLIAMS said that he had operated upon one case of cancer of the rectum in the manner described by Dr Peck At the conclusion of the perineal removal, he thought it best to make an inguinal colostomy This he did by drawing out the sigmoid, dividing it and sewing up completely the distal end which he dropped back The perineal end was likewise closed and a drain inserted to it This was five years ago and the man is still alive and well Occasionally there is a slight discharge of muco-pus from the upper part of the sacral scar, but not enough to be annoying and soon ceasing

DR WILLIAM C LUSK said that once, in a case of amputation of the rectum, on the advice of Dr Bryant, he had isolated a segment of the pelvic colon without any disturbing sequel At a preliminary operation the sigmoid loop was divided, and with the proximal end a permanent artificial anus was established, while the distal end was closed by suture and returned to the peritoneal cavity Subsequently by the perineal route, the rectum was amputated through its extra-peritoneal portion after pushing upward the recto-vesical pouch, the lower end of the segment of bowel remaining in the pelvic cavity was inverted and sewed up, and the stump sutured at the middle of the skin incision which was closed over it The wound at first healed completely, but soon after a sinus developed, which, on being laid open thirteen

months after the operation, was found to be associated with two retained silkworm gut sutures. There was no communication whatever with the closed off segment of bowel. The wound then healed completely and no sinus ever developed subsequently. The patient died of a pneumonia three years and four months after the bowel segment was isolated. Dr Lusk said that the case was reported in the *Medical and Surgical Report of Bellevue and Allied Hospitals*, vol i, 1904.

#### EMPYEMA, WITH CHRONIC SINUS FORMATION

DR GEORGE E BREWER presented a man, twenty years old, who was admitted to the Roosevelt Hospital on February 19, 1912, with the history that two years prior to his admission he had an attack of pneumonia, which confined him to bed for six weeks. Following this attack there was profuse expectoration of a greenish, yellow sputum, most abundant on rising, with severe cough when lying on the right side. About ten days later a tender mass developed to the right of the sternum; when this was incised there was a discharge similar in character to the expectoration, which then immediately ceased, together with the cough. Subsequently, three additional abscesses formed; these were incised, and left sinuses which were still discharging at the time of his admission to the hospital. The patient said he had lost 30 pounds in weight. There was no history of chills or fever.

An examination showed a scoliosis of the spine, with the convexity to the left. Expansion of the chest was two and a half inches on the left side, absent on the right. There were four discharging sinuses along the right side of the costochondral articulation, lined by unhealthy looking granulations. An examination of the blood showed 17,000 white blood cells, with 68 per cent of polynuclears. The von Pirquet test was positive.

Dr Brewer did a partial ostectomy of the 4th, 5th, 6th, 7th, 8th, and 9th ribs, followed later by the application of Bier's cup. When the patient left the hospital, on June 10, 1912, he still had a shallow sinus, with slight discharge. His general health was much improved, and up to the present time he had gained about twelve pounds in weight.

He was readmitted to the hospital on January 21, 1913, because of a slight hemorrhage from the sinus about a week ago. He stated that since his discharge last June the sinus had closed.



four times, remaining closed about a week each time At present, it discharged about two ounces of pus daily

A pathological examination of some of the tissue from the sinus showed tuberculosis, with chronic inflammation

#### PERFORATING DUODENAL ULCER

DR BREWER presented a man, thirty-five years old, who was admitted to the hospital on September 14, 1912, with the history of epigastric pain which had come on about three o'clock in the afternoon each day for the past two weeks He gave no previous symptoms For two hours prior to his admission he had suffered from an acute pain, colicky in character, which was more or less general, but most severe in the epigastric area His bowels were constipated, he felt nauseated, but did not vomit An examination of the blood showed 17,000 leucocytes, with 91 per cent of polynuclears

An immediate operation by Dr Brewer revealed a duodenal ulcer, about the size of a buckshot, about an inch below the pylorus There was much free fluid in the peritoneal cavity A posterior gastro-enterostomy, with suture, and an enteror-rhaphy were done, and the patient made an uneventful recovery His temperature reached normal on the third day, and he was discharged on October 2, 1912

Dr Brewer presented also a man, forty-three years old, a peddler, who was admitted to the hospital on September 16, 1912 His present illness dated back two years, when he began to have epigastric pain, burning in character and radiating through to the back The pain was constant, but most severe about two hours after meals He usually had one or two daily attacks of vomiting, about two hours after meals, when his pain was most severe The vomitus was sour, there was no blood The bowels were constipated, the stools very dark in color A blood count showed 68 per cent of hæmoglobin, 4,000,000 red blood cells, leucocytes, normal in number. A gastric analysis gave 87 per cent of free hydrochloric acid, with a total acidity of 105 An X-ray, taken after the ingestion of bismuth, showed no retention

Upon operation, which was done on September 18, 1912, a duodenal ulcer was palpated two and a half inches below the

pylorus, and upon pulling aside the stomach, gastric adhesions were found over a seeming previous perforation. When these adhesions were loosened, duodenal contents leaked out. As in the previous case, a posterior gastro-enterostomy, with suture, and enterorrhaphy were done, and the patient went on to uninterrupted recovery.

#### GASTRIC AND DUODENAL ULCER IN THE SAME PATIENT

DR BREWER presented a woman, twenty-five years old, who was admitted to the hospital on February 4, 1909. Her previous history had no bearing on her present illness. About two hours before admission she was seized with severe colicky pain in the epigastric region, and was unable to stand or walk. An immediate operation was done, revealing an induration, about one inch in diameter, on the posterior surface of the stomach, near the lesser curvature. In the centre of this indurated area was a small perforation, and the peritoneal cavity contained much cloudy free fluid. A gastrorrhaphy was done. The patient made an uneventful recovery, and was discharged on February 20, 1909.

On March 5, 1910, the patient was readmitted to the medical division of the hospital. At this time she complained of weakness and pain in the epigastrium, coming on after eating or after exercise. She had never vomited and blood had never been noticed in the stools. She improved under a palliative diet and was discharged on April 2, 1910. After this she remained free from symptoms for five months, when she again began to suffer from epigastric pain coming on about an hour after meals and persisting until she would produce vomiting. She had never noticed blood in the vomitus or stools.

The patient was again admitted to the hospital on November 20, 1910. At this time an examination of the blood showed 38 per cent of hæmoglobin, 2,900,000 red blood cells, with a normal leucocyte count. An analysis of the gastric contents showed free hydrochloric acid, 50, with a total acidity of 90. No lactic acid nor blood. No blood could be found in the fæces and the urine was negative. The patient was put on Lenharat's diet, and left the hospital on December 19, being instructed to return if necessary. She reappeared at the hospital three weeks ago.

complaining of loss of appetite and a sense of weight in the epigastrium, she had no pain or other gastric symptoms. Three days before admission she had vomited a large quantity of blood, which had temporarily relieved the sense of fulness in the epigastrium.

*Operation* (January 11, 1913) —A small indurated area, the size of a buckshot, was found in the first part of the duodenum. A gastro-enterostomy, with suture, was done, and the patient made an uneventful recovery.

### ULCER OF THE DUODENUM

DR BREWER presented a man, twenty years old, a machinist, who was admitted to the hospital on January 11, 1912. The history obtained was that for nine months prior to his admission he had suffered from pain in the right upper quadrant of the abdomen, which occurred about three times weekly and had no relation to the taking of food. It was never very severe and did not radiate. For the past three months, however, the pain had become more severe, it was now almost constant and was accompanied by vomiting. The vomitus was bitter rather than sour and contained no blood. His bowels were regular, he had never noticed that his stools were darker than normal.

Examination showed a point of slight tenderness in the mid-clavicular line, just below the right costal margin. A stomach analysis showed free hydrochloric acid, 34, with a total acidity of 60. No lactic acid, no blood.

*Operation* (November 16, 1912) —The gall-bladder was found normal, there were no stones. The first portion of the duodenum was thickened, and there was an ulcer, about one-quarter of an inch in diameter, located an inch from the pylorus. The patient made an uneventful recovery and left the hospital on December 1, 1912.

Dr Brewer presented also a man, forty-nine years old, a farmer, who was admitted to the hospital on October 22, 1912. For the past two years he had complained of epigastric pain of increasing severity. At first these attacks were periodic in character, lasting about a month, but for the past five months the pain had been almost constant; it was worse just before meals and was temporarily relieved by eating or by the administration

of alkaline remedies. The patient often induced vomiting to relieve the pain. The vomitus was clear and exceedingly sour, and three months ago he had vomited a cupful of dark, clotted blood. The stools had been dark on numerous occasions. The patient stated that about eight years ago he had had a similar attack, lasting three months, during which he had vomited blood twice. He had never been jaundiced.

On admission, the patient's blood count was normal. A gastric analysis showed free hydrochloric acid, 64, with a total acidity of 98. No blood. The X-ray showed no retention.

Upon operation by Dr. Brewer on October 20, 1912, an infiltrated area, with a puckered scar on its surface, was found in the duodenum just below the pylorus. A posterior gastro-enterostomy, with suture, was done, and the patient made an uneventful recovery, leaving the hospital on November 14, 1912.

Dr. Brewer, in reply to a question as to his method of treating the peritoneal cavity in the cases of perforating duodenal ulcer, said that if he felt fairly well assured that he had gotten rid of all the dead matter, he closed the wound tightly, if, however, there was any doubt about this, he inserted a large cigarette drain directly into the wound, or, in some cases, through a stab-wound in the bottom of the pelvis. In none of these cases had he closed the pylorus; he did this in cases of bleeding ulcer, but not in perforating ulcer. If we had at our command a rapid method of closing the pylorus, he thought it might be wise to resort to it in some of these cases, and he was now doing some experimental work with that object in view.

In cases of acute perforation in the duodenum, Dr. Brewer said he always washed out the peritoneal cavity. While he had no doubt that the peritoneum could take care of a certain amount of infection, he was in favor of removing as much of the infective material as he could without endangering the life of the patient.

DR. WILLIAM A. DOWNES said he had operated on perhaps fifteen cases of perforating gastric and duodenal ulcer, and had never washed out the peritoneal cavity. In cases where there was a good deal of soiling, he had used the suction method. Under this treatment the majority of their cases at the New York Hospital had recovered.

DR. A. V. MOSCHCOWITZ said that in dealing with chronic

duodenal ulcer he made an attempt to close the pylorus by infolding it by means of a series of sutures. He thought by doing this future disturbance might be prevented, and he believed that this occlusion of the pylorus functionated, at least long enough to give the ulcer a chance to heal.

DR BREWER said that while theoretically he appreciated the fact that the pylorus should be closed off, he had yet to see a case of duodenal ulcer that was not permanently relieved by a gastro-enterostomy without closure of the pylorus.

DR ERDMANN said he could not recall how many gastro-enterostomies he had done at the Post-Graduate Hospital and in private practice without occluding the pylorus, and he had never seen any bad results follow.

DR EUGENE H. POOL said that in connection with the discussion concerning doing a gastro-enterostomy and leaving the pylorus patent he had in mind another procedure which he thought could be done in a limited number of cases of small chronic ulcer of the anterior wall of the first part of the duodenum, in which there were not many adhesions. Under those conditions he thought we could do a Finney operation, at the same time removing the involved area, and getting a wide low outlet draining the lowest part of the stomach. Dr Pool said he had followed this method in a case which came under his care last July, and the results were admirable. Of course, this could only be done in a very limited class of cases.

DR PECK thought that a gastro-enterostomy opening, properly made, did not close with a patent pylorus as quickly as was the general impression to that effect. He recalled a case where several years after a gastro-enterostomy bismuth passed very readily through the artificial opening, as shown by radiographic pictures. He thought it had not been proven that such a closure did generally occur, and that the gastro-enterostomy opening failed to functionate when the pylorus was left open.

DR MOSHCOWITZ said he could recall two cases where the gastro-enterostomy opening could not even be found at a second operation, and there were barely traces of adhesions between the jejunum and stomach. In order to show how difficult it is to occlude the pylorus, he would mention a recent case in the service of Dr Arpad G. Gerster in which the pylorus was ex-

cised and both ends sewn up and a gastro-enterostomy was done. The patient subsequently returned with a recrudescence of symptoms and an X-ray showed distinctly that bismuth was passing down not only through the gastro-enterostomy opening, but also through the pylorus, connection through this having been re-established with the stomach within eight months after the primary operation.

DR CHARLES A. ELSBERG said that experimentally it had been found very difficult to make an excision of the pylorus in dogs, as the connection with the stomach was often re-established. The same was true after excision of the common ducts and tying off the ends.

#### EXSTROPHY OF THE BLADDER.

DR GEORGE E. BREWER presented a lad, sixteen years old, with an exstrophy of the bladder which had been unsuccessfully operated on in childhood. When the boy was admitted to the Roosevelt Hospital, on November 12, 1912, he had an open, granulating area in the suprapubic region, through which the posterior wall of the bladder could be seen. Below this was a rudimentary glans penis and the testes could be felt below the inguinal rings.

A week after admission, Dr. Brewer did a sigmoid implantation of the ureters. The boy's temperature rose to  $103.8^{\circ}$  on the fourth day after the operation; then it gradually fell to normal on the ninth day and remained below  $100^{\circ}$  until January 8, 1913, when there was a sudden rise to  $103^{\circ}$ , and on the following day to  $104.4^{\circ}$ . There was no explanation for this temperature excepting slight costovertebral tenderness on both sides. His blood count at the time showed 17,000 leucocytes, with 82 per cent of polynuclears. A blood culture was negative. Two days later the temperature fell to normal and had remained so up to the present time.

For five days following the operation the patient had passed from 21 to 60 ounces of urine daily in small quantities and at frequent intervals. During this period he was given colonic irrigations twice daily. During the next two weeks he passed about two ounces of urine every two hours, and since then he had been passing about four ounces every four hours. The urine

was cloudy, alkaline in reaction, with a specific gravity of 1020. It showed a faint trace of albumin and a few white blood cells; no casts.

Dr Brewer, in reply to a question as to the possibility of a resulting nephritis after implantation of the ureters into the bowel, thought that complication would doubtless follow in a fair proportion of cases. In the two cases where he had thus far resorted to this procedure, there had been no nephritis.

Dr ERDMANN said that in one case where he had transplanted the ureters into the bowel, by the Maydl method, the patient, a child, survived the operation about 12 days, dying from pneumonia. Since then he had done a direct implantation in two patients, both ended fatally by ascending infections after the 10th to the 15th day.

Dr ELSBERG said he had one case where he implanted the ureters into the sigmoid and made lateral entero-anastomosis at the base of the loop so as to exclude the fecal stream as much as possible. The patient died a month or two later from double kidney infection.

#### ULCER OF THE STOMACH

Dr BREWER presented a man, fifty years old, who was admitted to the hospital on March 4, 1912. The history obtained was that during the past three years he had suffered from six attacks of abdominal pain, accompanied by vomiting, each lasting perhaps four or five weeks. The pain was of a burning or gnawing character, located in the epigastrium, radiating to the back, but never to the shoulder. The pain came on within fifteen to thirty minutes after eating, and lasting from a few minutes to an hour, being relieved by vomiting. The vomitus consisted of acid tasting food and sometimes contained remnants of food that had been taken twenty-four hours before. Vomiting was usually preceded by sour eructations.

The patient's present attack began ten days ago and since its onset he had on three occasions vomited dark, coffee-ground material, the last time 48 hours before admission. He had never noticed this kind of vomitus during previous attacks. He was usually constipated, especially during these attacks. Blood had never been noticed in the stools, nor were they of an unusually dark color. During one of his attacks, about a year ago, he had

been jaundiced No chills nor fever. During these attacks he dieted himself strictly and lost in weight, but his lost weight was regained during the intervals Examination revealed epigastric pain, no masses

Upon operation, which was done on March 4, 1912, a saddle-shaped ulcer was found on the lesser curvature of the stomach, involving both the anterior and posterior surfaces, and located about three inches from the pylorus In its centre was a round, punched-out area, three-quarters of an inch in diameter and half an inch deep, with a surrounding indurated area an inch and a half in diameter. The stomach was dilated, there were no adhesions.

A partial gastrectomy was done The patient required an intravenous infusion at the completion of the operation There was no nausea nor vomiting. The wound healed by primary union, the sutures were removed on the eleventh day, and the patient left the hospital on March 31, 1912 Pathological report Chronic inflammation in gastric ulcer



## CORRESPONDENCE.

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### THE GLASGOW LISTER WARD AND MUSEUM

As a memorial to the late Lord Lister, and as a means of perpetuating his memory in a way that it is hoped will prove both interesting and instructive to every member of the medical profession for all time to come, one of the wards in the Royal Infirmary, Glasgow, in which he worked out and first put into practice the principles of antiseptic surgery, is to be reserved and utilized in the following way One part of the ward is to be refurnished as it was in his time with such objects as it may be possible to acquire, while the other part is to be made into a museum for the exhibition of anything associated with the life and work of the great master

It is, therefore, asked that any who may have letters, pamphlets, books, or other objects of direct personal association with Lister and his work will either present or loan them to the museum

Professor John H Thacher, M D, Hon Curator of the Museum, will be pleased to receive any objects addressed to him at the Royal Infirmary, Glasgow, Scotland

The names of all donors or senders of objects are to be affixed to the exhibits

A ERNEST MAYLARD,

Chairman of the Museum Subcommittee of the Glasgow  
Lister Memorial Committee

12 Blythswood Square,  
GLASGOW, SCOTLAND

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## ORIGINAL MEMOIRS.

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### LYMPHANGIOPLASTY: HANDLEY'S METHOD \*

BY PARKER SYMS, M D,  
OF NEW YORK,

IN the *Lancet* of March 14, 1908, W Sampson Handley<sup>1</sup> published a preliminary note on "A New Method for the Relief of the Brawny Arm of Breast Cancer and for Similar Conditions of Lymphatic Œdema"

The term "lymphangioplasty" was proposed by Handley for a method of producing new channels for the flow of lymph, in other words, new or artificial lymph-ducts Handley has accomplished this to his satisfaction by the introduction into the subcutaneous tissues of strands of tubular silk

When Handley proposed this method he was doubtless not aware that Lambotte<sup>2</sup> had used the same principle in an attempt to drain the abdominal cavity in a case of ascites Of this I shall speak in its proper place

Handley states that brawny arm occurs in 16 per cent of cases of breast cancer He believes the pathology of this condition is to be found only in accepting his theory as to the permeation of cancer If his conception of the condition be true, then brawny arm exists only in cases where cancer is present and is progressive I am not prepared to agree with Handley in his idea of the pathology and pathogenesis of this condition I have had cases in which brawny arm has

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\* Read before the New York Surgical Society, February 12, 1913

occurred after the radical operation for cancer and in which there were no other evidences of the recurrence or the continuance of the original disease

Be that as it may, it is not my purpose in this paper to enter into a discussion of the etiology of brawny arm and like conditions, but rather to confine myself to the consideration of the operative procedure which Handley has proposed, and to place before the profession data which will serve to determine whether the operation has proved successful or not

To do this I have made a search of the literature since Handley's original proposition, with the idea of collecting all reported cases and classifying them as to the conditions for which the operation was employed, and tabulating the results obtained by Handley himself and by other operators. In going over the literature I find that the operation has been employed for the following conditions: brawny arm, the result of breast cancer, elephantiasis, chronic œdema of the leg, chronic or hard œdema of the face and eyelids following erysipelas, and ascites due to cirrhosis of the liver. I have purposely omitted from this review cases of hydrocephalus and serous meningitis, as well as one or two other conditions for which the operation has been suggested, feeling that the examples I have taken are sufficient for our purpose.

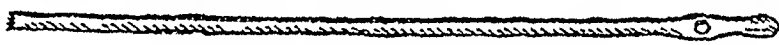
I find that the operation has been performed in 20 reported cases of brawny arm, in 17 cases of elephantiasis, in 3 cases of chronic œdema of the leg, in 3 cases of solid œdema of the face and eyelids, and in 10 cases of ascites. This does not include a number of cases reported as having been operated upon, but in which no details are given.

The above is the result of a careful study of the literature for reported cases. While it is not claimed to be complete, it certainly covers most of the cases thus far recorded.

I was so much impressed with the possibilities of this operation that I have employed it in two cases, one of brawny arm following cancer of the breast, and one of ascites due to cirrhosis of the liver.

The case of brawny arm has already been recorded, having been exhibited before the New York Surgical Society on January 8, 1913.<sup>3</sup> In that particular case there was no other evidence whatever of recurrence or continuance of carcinoma. The swelling came on about a year after the operation for removal of the breast, which was performed three years ago. The patient is in perfect health and vigor, she has perfect use of the arm and hand, and is free from pain. I performed Handley's operation for the swelling of her arm on March 23, 1912, more than two years after the first operation. As far as I can estimate, the result of this lymphangioplasty was a failure. There is no pain now, but there was no pain before this operation. There has been no diminution in the size of the arm. I performed the lymphangioplasty after the method of Handley, except that I used a single loop of silk at the anterior and at the posterior aspect of the limb instead of a double one as advised by Handley. I have not had the woman keep her arm in an elevated position as advised by Handley.

FIG 1



Sims's probe for lymphangioplasty

For the purpose of this operation I devised a special probe which was exhibited at the New York Surgical Society on January 8, 1913 (Fig 1). It has a bulb and an eye at the same end. This is a great advantage when it comes to that part of the operation in which we desire to unthread the silk.

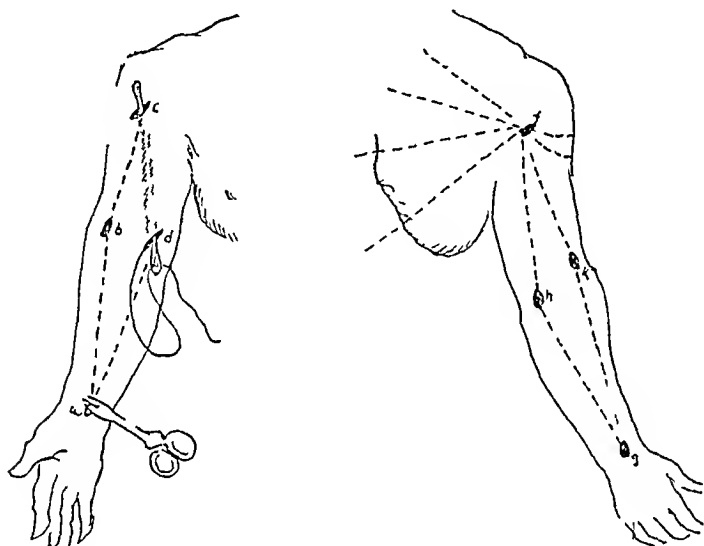
My second case was one of ascites due to cirrhosis of the liver. In this case I did an omentopexy after the manner of Narath, and I also employed lymphangioplasty as described by Handley. Immediately after the operation the abdomen refilled, but it soon began to subside and a few days after the operation there was no evidence of fluid within the abdomen. There was swelling in the region of the thighs where the threads terminated, the lower wound had partly separated, and some drainage along the silk threads could be seen. There was also evidently some drainage in the subcutaneous pocket where the omentum was placed. My impression is that this case was being satisfactorily drained and I had hoped to be able to report a good result, for the progress was encouraging. Unfortunately the patient went into a sudden

collapse 15 days after the operation and died. The patient's untimely death and the fact that there was no autopsy obtained unfortunately make the case of little value as a clinical report.

*Brawny Arm*—Inasmuch as it was for brawny arm that Handley first proposed this operation, I shall proceed at once to a consideration of this phase of our subject.

I feel that I cannot make a better introduction than by quoting Handley's own description of the method of operating

FIG 2



Handley's lymphangioplasty (Binnie)

“The tissues of the arm are drained by two long U-shaped lines of silk, each line composed of two threads of No 12 tubular silk. One of these lines drains the front of the arm, the other the back. The bend of each U lies immediately above the wrist, and its two limbs occupy respectively the radial and ulnar sides of the limb. Thus, along the whole length of the limb, are found four double lines of silk, spaced out around the limb as nearly as possible at quadrant intervals. Toward the shoulder the lines of silk on the flexor aspect curve outward around the deltoid muscles, and converge to meet the ascending threads from the posterior aspect at a point near the posterior border of the deltoid. From this point the silk threads again radiate in the subcutaneous tissue of the back, terminating by free ends in the subcutaneous tissues of the scapular region. It is perhaps still better to lead some of them to the scapular region of the opposite side, and others to the lumbar region of the same side, if there is any sign of the œdema extending from the arm to the trunk.

"The operation is done as follows (Fig 2) Take a double line of silk rather more than twice as long as the arm, and mark its mid-point by clipping on it a pair of artery forceps Wrap up one-half its length in gauze Thread the two free ends of the other half through the eye of a long probe Make an incision one-half inch long through the skin at the middle of the front of the forearm, just above the wrist-joint Thrust the probe in the desired line upward in the subcutaneous tissues well away from the skin toward the region of the elbow, as high as is convenient, and cut down upon its point Withdraw the probe through the incision last made, and draw the silk after it as far as it will come Introduce the probe through the incision from which it has just emerged, thrust it upward again in the selected line, and repeat the foregoing steps until the point selected for the convergence of the threads is reached Here an incision one inch long is made, through which the probe with its two silk threads is drawn out The other half of the silk loop is now led upward in the selected line along the other border of the flexor surface The limb is turned over and the extensor loop of silk is similarly introduced When this has been done eight free ends of silk are hanging out from the incision of convergence at the posterior border of the deltoid Two at a time these are tucked away in various directions in the subcutaneous tissues of the back by the following manœuvre.

"Clip a forceps on the selected pair of silk threads just where it emerges from the topmost incision Take a long probe, cut off the ends of the two threads so that they are four inches shorter than the probe, and thread them into the eye Thrust the probe downward from the incision in the desired direction until the probe unthreads itself Withdraw the probe carefully, leaving the two silk threads to occupy its track When all the threads have thus been tucked away the operation is completed by sewing up the incisions with horsehair"

It was found that lymphangioplasty has been performed for brawny arm in 20 recorded cases Of these, 9 cases were reported as successful, 9 as failures, and in 2 cases there was no report as to whether the swelling had subsided or not These 20 operations were performed as follows 15 times by Handley,<sup>4</sup> twice by Gamgee,<sup>5</sup> once by Clarke,<sup>6</sup> once by Goebel,<sup>7</sup> once by Symms<sup>3</sup>

Handley had some success in 8 cases and failures in 7 Gamgee reported 2 cases in which he claimed improvement as to pain, but in which he made no record as to whether or not there was a reduction in the amount of swelling Clarke claimed success in his case, stating that the swelling was reduced He did not, however, give comparative measurements Goebel's case was a failure, and, as previously stated, my own was a failure

It is to be noted that Handley states that the patients after operation must keep the arm on an elevated plane for several hours during the day, and that otherwise the swelling is liable to recur. Handley's cases have been reported in detail and some of his results are very gratifying, but in none of his cases did the arm return to its natural size, though there was great reduction in the swelling. And it must not be forgotten that he insists upon elevation of the limb during several hours of each day as a part of the routine after-treatment. Of course gravitation exerts a very determining influence in such conditions of swelling.

*Elephantiasis* —Let us now consider elephantiasis. Lymphangioplasty has been performed for this condition by Handley<sup>8</sup> in 2 cases, by Deaudt<sup>9</sup> in 2 cases, by Lexer<sup>10</sup> in 2 cases, by Goebel<sup>7</sup> in 1 case, by Lanieris<sup>11</sup> in 2 cases, and by Madden, Ibrahim and Ferguson<sup>12</sup> in 8 cases.

The results in these 17 cases may be said to represent 17 failures. There was no case of cure. In practically all of the cases there was no improvement whatever. In one of Lexer's cases there was claimed to be partial success.

The most noteworthy contribution to the subject of lymphangioplasty in the treatment of elephantiasis is that of Madden, Ibrahim and Ferguson. These authors state that their clinical results are entirely in accord with the statements of Handley to the effect that lymphangioplasty has failed to establish its position in the treatment of elephantiasis. Their findings, however, in and around threads taken from the limbs two or three weeks after lymphangioplasty, and in others experimentally introduced into the subcutaneous tissue of guinea pigs, appear to show that failure is not due only to the action of gravity to which Handley refers but also to the fact that the artificial lymph channels will not persist for any length of time. There is finally an obstruction to the lymph return from obliteration of the lymphatics in the neighborhood of the inserted thread. Handley's technic was carefully followed in all of their cases.

The authors conducted three series of observations in order to determine the fate of the silk threads buried in the tissues

The first series concerned the conditions after lymphangioplasty in a healthy patient. The second concerned the condition of the thread and surrounding tissues after lymphangioplasty for elephantiasis, the third concerned experimental lymphangioplasty in healthy guinea pigs.

The conclusions, drawn from their clinical observations and from their experimental investigations, are so interesting and important that I feel they should be quoted in full:

"1 Clinically, it is abundantly evident that lymphangioplasty fails to effect anything but a very temporary improvement in elephantiasis of the legs. The swelling is very markedly reduced within 48 hours after the operation, but the improvement persists only so long as the recumbent position is maintained. Within at most 21 days after the operation, or as soon as the patient begins to walk, the swelling invariably returns and no permanent improvement results.

"2 The examination of the tissues surrounding the threads introduced during the operation of lymphangioplasty in cases of elephantiasis, and also around threads introduced into healthy tissues of man and of guinea pigs, supplies very adequate reasons for the failure of the operation.

"Important as the action of gravity may be in contributing to the failure to maintain a new and artificial lymphatic circulation, it appears that this want of success is due in far greater degree to definite reactive changes in the tissues immediately around the thread, which soon isolate the new lymph tube from the surrounding lymphatic areas and eventually completely obliterate it.

"Briefly the series of changes in the tissues around the buried longitudinal threads in the subcutaneous tissues are as follows:

"1. For a short time the threads, by virtue of their capillary action, drain the surrounding tissues of the lymph contained in them.

"2 The threads in the tissues soon excite a definite cellular reaction, which leads comparatively soon—from 14 to 21 days—to the formation of a dense and progressively contracting fibrous tissue. This walls off the thread and crushes the ad-



jacent lymphatics out of existence, and thus effectually prevents any absorption of fluid into the space immediately around the thread itself. These fibrous changes, occurring around the ends of the thread, as well as along its whole length, eventually completely isolate it, and it may then perhaps be compared to a long worm lying within an impermeable sheath.

"3 The thread is later penetrated by rows of cells, running in along its fibrils, which must eventually lead to its complete disintegration, and the formation of a solid column of dense fibrous tissue along which no absorption of fluid of any kind can possibly occur."

*Chronic Œdema of the Leg*—Lymphangioplasty has been performed in three recorded cases of chronic œdema of the leg. Clarke<sup>6</sup> reported two cases, with improvement, and Haslam<sup>13</sup> reported one case as cured.

*Chronic Œdema of the Face and Eyelids*—Three cases have been reported in which lymphangioplasty has been performed in this condition, two by Mitchell,<sup>14</sup> and one by Taylor.<sup>15</sup> In each of these cases a permanent cure resulted.

*Ascites*—As far as I know Lambotte<sup>2</sup> is entitled to the credit of originating the idea of attempting to drain the abdomen by means of silk threads. He reported his case in 1905, three years before Handley's first article on the subject.

Silk thread drainage has been employed in the treatment of ascites by several surgeons. Of the available recorded cases, ten may be specially considered. (Paterson<sup>16</sup> mentions the fact that he employed this method unsuccessfully in several cases.) Lambotte<sup>2</sup> employed this method in 1 case, without success. Handley<sup>8,17</sup> performed the operation 5 times, twice successfully and 3 times unsuccessfully. Stoney and Moorhead<sup>18</sup> report 1 case, with success. Villard and Tavernier<sup>19</sup> employed lymphangioplasty in conjunction with Ruotte's operation in 1 case, with partial success. Rosenberger<sup>20</sup> combined lymphangioplasty with Talma's operation in 1 case, with success. My own case as stated is of little value as a clinical report though it did show something as to early drainage.

For a description of the technic to be followed when employing lymphangioplasty for the drainage of ascites, I again quote Handley's own words:

The abdomen was opened in the left semilunar line, "a stout needle threaded double with lymphangioplasty silk was now passed in and out in a series of loops through the peritoneal cavity, whence they could suck up fluid by capillary attraction. The process was repeated with two other threads. The four threads were conducted in the manner described to a point close to the anterior superior spine. With the aid of a long probe they were then thrust beneath the outer end of Poupart's ligament some way downward into the subcutaneous tissues of the thigh. The abdominal wound was now closed in such a way that the sutures used proved additional permanent channels for the escape of fluid from the peritoneal cavity. A number of thick silk ligatures were employed, taking up the peritoneum and the muscular layers of the abdomen but leaving out the skin. These were tied and the skin was then closed over them with a continuous superficial suture."

The study of the above cases of ascites treated by means of silk thread drainage shows thus far that of the ten cases in which it was employed successes and partial successes or failures are about evenly divided. In two of the more or less successful cases lymphangioplasty was used in conjunction with other operative procedures. In the fifth edition of Binnie's <sup>21</sup> work on Operative Surgery will be found an excellent treatise on this subject.

In summing up our findings of reported cases of the application of lymphangioplasty in various conditions, we see that the results have been as follows:

Brawny arm, 20 cases, with 9 successes and 9 failures, and 2 cases with no report as to swelling.

Elephantiasis, 17 cases, with practically 17 failures.

Chronic cedema of the leg (not elephantiasis), 3 cases, with 3 successes.

Chronic cedema of the face and eyelids, 3 cases, with 3 successes.

Ascites, 10 cases with success in 5 and with partial success or failure in 5.

In considering the results in brawny arm and in studying the reports of cases, we must give due consideration to the

more or less indefiniteness of the condition I have classed as successes those cases in which there was marked diminution in the swelling and in which there was satisfactory relief of pain and disability I do not believe that the operation has been a complete success in any of the cases thus far reported, nor do I believe that it has been claimed that the operation produces a restoration amounting to the normal condition. However, I think it is fair to concede that the operation has been a success in any case in which it has produced a marked reduction of the swelling with a consequent improvement in the subjective symptoms.

The scientific investigation made by Ibrahim, Madden and Ferguson is of the utmost importance. It would seemingly demonstrate the fact that the method may be useless, certainly it has proven so in cases of elephantiasis. My own feeling is that the operation is a very ingenious one, and is well worthy of further trial. In a limited number of cases it has met with success in the treatment of chronic œdema of the face and of the leg (not due to elephantiasis). I must confess that I feel sceptical as to its success when employed for the relief of brawny arm, though I shall certainly give it a further test. I have a feeling that we may find its greatest usefulness in cases of ascites due to cirrhosis of the liver. In cases of ascites I believe lymphangioplasty should be combined with the best form of omentopexy. In my opinion Narath's method of omentopexy is the best one which has yet been proposed. It may be that these patients can be relieved by the establishment of a collateral circulation through the omentum. On the other hand, the explanation of the relief which has been obtained may be found in Binnie's <sup>21</sup> suggestion that in the performance of omentopexy there has been established some incidental process of internal drainage. In the case reported by me I believe there was a drainage of the ascitic fluid to the subcutaneous tissues along the line of the omentopexy.

If the above report may act as an aid to the profession in throwing light on this interesting subject, I shall feel well paid for my humble efforts in that direction.

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# INTERSCAPULOTHORACIC AMPUTATION OF THE SHOULDER \*

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FROM my experience I should say this is an operation called for far more frequently than it is performed, if we judge from the number of cases reported. In my practice I have advised the procedure in many cases where I thought it justifiable, but all, except the two reported below, have refused to submit to the operation. No doubt many cases that have been operated upon have not been published, still this would not account for the few recorded, when we consider the frequency of the conditions demanding such an operation. These conditions are, first, traumatisms of the shoulder, including gun-shot wounds. While the mortality in these cases is necessarily high (25 per cent) from shock, hemorrhage and infection, I have no doubt that in the future, with the aid of intratracheal insufflation, nerve block, transfusions, etc., this mortality will be much reduced. Second, cases of extreme bone disease of the shoulder and upper arm. Third, all cases of sarcoma of the arm and shoulder, except possibly those of giant-celled sarcoma limited to the lower two-thirds of the humerus. Fourth, all cases of carcinoma involving the upper half of the arm, and in some cases of carcinoma of the breast, where the axilla and arm are involved. Fifth, some cases of tuberculous disease.

While there is no doubt that we are indebted to Paul Berger for the first detailed description of the operation, still he was not the first to do it, as Treves<sup>1</sup> gives Ralph Cummings, a surgeon in the English navy, the credit of having done it in 1808, and John Langton, President of the Clinical Society of London, at the meeting of the Society, March 25,

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\* Read before the St Louis Surgical Society, Nov 20, 1912

1898, stated that Cheselden had performed the operation a century and a half ago. While several others are given the credit of being the first to perform this operation, it would seem that the honor rightly belongs to Cheselden.

This operation is demanded, as stated above, in all cases of sarcoma of the humerus, except the giant-celled variety, limited to the lower two-thirds of the arm, and in no case should the surgeon consent to do an operation for sarcoma of the arm without an immediate complete removal, which can only be accomplished by an interscapular amputation of the shoulder. If there should be any uncertainty as to diagnosis, that must be settled and the operation proceeded with at once. Early operation by the interscapular thoracic method should be insisted upon, so soon as the tumor is recognized, as the literature on sarcoma affords ample evidence of the necessity of prompt and radical action.

The necessity for this immediate radical action is well illustrated by a case, reported by Cobb,<sup>2</sup> of giant-celled sarcoma of the humerus, of periosteal origin, of only eight weeks' duration. A diagnostic incision being insisted on by the patient showed that the deltoid was infiltrated. Very sharp reaction followed, and eight days later, when the major operation was performed, sarcomatous thrombi were found in the subscapular vein, possibly dislodged at the time of the primary operation.

In Case II reported below, the tumor was removed locally but recurred immediately, and when I first saw the patient four weeks after removal the entire arm was infiltrated to the shoulder, thus necessitating the removal of all the muscles of the arm leading to the thorax.

The necessity of doing the interscapular thoracic amputation in cases of giant-celled sarcomas, involving the upper third of the humerus, was impressed upon me by a case which I had some time ago. The patient was on the table to have this amputation done, when members of the family interfered, and against my better judgment I did a shoulder-joint amputation, and, while there was no local recurrence, the patient

died about two years later from metastasis in the liver, due possibly to the opening of the sources of infection during the operation

Keen<sup>3</sup> thinks it possible that when the disease has invaded the medullary canal that operation may already be too late on account of the physiological fact that the bone marrow has a share, and probably an important one, in the production of the red blood-cells. If this be so it is possible that by this means the blood may be contaminated at the very fountain, and the disease being distributed, metastasis is readily produced, even if the disease has been so thoroughly removed that recurrence *in situ* does not take place

While the operation is an extensive one and requires much time on account of the careful dissection necessary in order to avoid great loss of blood, thus helping to produce shock, still the mortality is only about 4 per cent in tumor cases, and 25 per cent in traumatisms

According to all authorities the chief danger in this operation is due to hemorrhage, but this can be limited in most cases by tying the axillary artery and vein, a procedure not always easy, but accomplished with comparative ease by resecting the clavicle either in part or as a whole, as recommended by La Conte<sup>4</sup>. However, I cannot think this latter procedure at all necessary, unless the clavicle itself is involved in the disease. I had no difficulty in either of my cases, although in my second case the patient was a very muscular subject, and the artery and vein very deep seated. I found the difficulties of the operation very much lessened by first dividing the pectoral muscles as close to their origin as possible, from above downward, for the reason that it is very easy to include the artery and vein in the clamps applied to the muscles and which I did in my first case—afterward resecting the middle third of the clavicle either without removing the periosteum or subperiosteally as recommended by Professor Ollier<sup>5</sup> as a safeguard against wounding the vessels. M. Chevasse says, "that particularly this step is not to be recommended, as the periosteum when left obscures the subclavius muscle, and had to be in

mediately divided." In my first case I resected the middle third of the clavicle subperiosteally, while in my second case I did not attempt it, and the only difference that I could see in the two methods was that the first method required more time; and I shall not use it in the future. It is certainly not to be considered in cases where the clavicle itself is involved in the disease, as it is likely to favor recurrence. After dividing the pectoral muscles and resecting the clavicle, the subclavius muscle and fascia covering the vessels and nerves should be carefully divided and drawn outward, thus fully exposing the vessels and nerves. The artery should be tied first, and the vein later, after the arm has been emptied of its blood by elevating it until it is blanched. By tying the artery first and emptying the vessels much blood is saved to the circulation, and the danger of wounding the vein and thus causing a troublesome hemorrhage and at the same time allowing the entrance of air into the circulation is diminished, one of the dangers of the operation, and, while not necessarily fatal, is nevertheless to be avoided if possible. In spite of all precautions, however, the loss of blood will sometimes be considerable from a general oozing from the wound surface.

By blocking the nerves and taking other precautions, unnecessary to mention, shock may be prevented in some cases, but not in all, as was demonstrated in my second case. A study of the chart shows the blood-pressure and the pulse to present very little variation until very near the close of the operation, when the pulse went up and the blood-pressure down. This was, no doubt, due to the loss of blood, which, while it did not appear to be very great, must have been more than was apparent, as there was more or less general oozing which it was impossible to control.

Speaking of shock, Cushing<sup>6</sup> says: "Cocaine injected into a nerve trunk effectually blocks the transmission of all centripetal or sensory impulses. Cocainization, therefore, of main trunks of nerves central to the proposed site of their division in a major amputation prevents the conduction of those impulses resulting from traumatic insult, which other-



wise by acting reflexly through the medullary centres might become the chief factors in the production of shock" He then cites two cases to prove the correctness of the above assertion In one case the nerves were not cocainized, immediate shock following the division of the nerve trunks, while in the other case in which the nerves were cocainized there was not the least evidence of shock

According to Cushing,<sup>6</sup> Crile did this operation without a general anæsthetic by simply blocking off the brachial plexus Cushing remarks that this method seems utterly impracticable and adds "This incision must pass through non-anæsthetized territories supplied by cutaneous nerves of thoracic segments These areas necessarily must be individually cocainized, a difficult performance and one requiring an accurate knowledge of segmental distribution"

In both of my cases the nerves were blocked with 1 per cent cocaine solution and in neither was there any evidence of shock manifested either by the pulse or by the blood-pressure, both of which were observed with great care when the nerve trunks were divided

Ether by the intratracheal insufflation method was the anæsthetic used This I think the method of choice, as it seems to limit shock and diminish very decidedly the post-anæsthetic effects

In traumatism one of the most frequent causes of death is infection, but this, although it cannot be entirely eliminated in the majority of cases, is not necessarily fatal, as Treves<sup>1</sup> cites a case operated upon by him on the battle-field during the late Boer War, which made an excellent recovery in spite of the fact that it was infected

In clean cases, infection plays a very unimportant part, as will be seen on a careful consideration of the literature Barling<sup>7</sup> reports 19 cases of new growths operated by this method, which he collected, all of which recovered

It is to be expected that in so extensive a mutilation as the interscapular amputation of the shoulder involves, that the operative mortality would be correspondingly high Such, however, is not

the case, as the records show in the non-traumatic cases since 1887 a very low mortality—some operators only 2 per cent. This, considering the cachectic condition of many of these patients at the time of operation, is certainly low.

While the immediate results of the operation are favorable, according to Jacobson and Rowlands,<sup>3</sup> the ultimate results are less so. "Recurrence, in the case of periosteal sarcomata, takes place, as a rule, within six or twelve months." Treves<sup>1</sup> is of the opinion that, "though interscapulothoracic amputation is probably the best measure in all cases of sarcoma (ossifying or not) of the upper part of the humerus, the prognosis is very gloomy. In at least 75 per cent. fatal recurrence has followed within a year."

On the contrary, Jeanbrau and Riche,<sup>8</sup> who made a study of the results of this operation, say "that thanks to the collaboration of more than 60 French and foreign surgeons, we have been able to collect the final results of 188 cases. These are so convincing that even the most sceptical must recognize the benefits which accrue, in cases apparently the most desperate, from Berger's operation. Moreover, the results are so much better than in all other operations for tumors, that the opposition of the patient should be overcome so that delay is done away with. It is a fact that patients, frightened at the thought of this mutilation which appears to them altogether out of proportion to the volume of the tumor, of whose malignancy they are ignorant, almost invariably refuse to be operated upon for some time. Experience has taught us that consent is given only after the neoplasm has ruptured the capsule and invaded the muscles."

"Even in the most unfavorable condition which could have been avoided had the opinion of the surgeon influenced the patient into consenting to an early operation, the Berger-Farabeuf operation yields good results and even effects cures that may be considered definite. In nearly every instance the patient is benefited to the extent that justifies the surgical intervention, which, done according to Berger's technic, is really an easy operation, hardly more difficult than a disarticulation of the shoulder."

"Our own researches are such that we are able to establish the following facts in interscapulothoracic amputation for malignant tumor made at the shoulder-joint, that is to say, not preceded by scapulectomy or scapulohumeral disarticulation. First, the mortality which was 29.16 per cent. before 1887 fell to 7.84 per cent. after asepsis and the technic of Berger-Farabeuf were made known. If we had at hand statistics showing what the exact circumstances were in the causation of death, we are convinced that the mortality would fall to 5 per cent. and even below this."

"Second, in taking the average in 105 cases operated upon, we find that the average length of life afterward is 35 months—nearly three years."

We also call attention to the fact that the estimates are the minimum in all cases alive in 1904, or lost to sight

"Third, this average survival of three years is a result almost unhoped for when we remember that this mutilation is not agreed to by the patient until the disease is very far advanced, and frequently not until the general condition of the patient is very bad

"Fourth, cure is possible, as we have traced 24 recoveries living more than five years. In 20 cases we note that patients of Roth, Kuster, and Ochsner lived more than ten years, those of Ochsner and Kuster more than 13 years, and that of Chavasse 15 years. One patient of M. Berger on whom he operated in 1882 was living in good health in 1898—16 years later. A patient of Syme lived 26 years, after which he was lost sight of.

"The study of these results is encouraging, and seems worthy of making known, because many medical men are sceptical as to the benefit which is conferred on the patient afflicted with sarcoma of the shoulder or the arm and also extending into the soft parts, by the interscapulo-thoracic amputation"

CASE I—H R, white, fifty-eight (?), German descent, occupation furniture finisher. Entered the Barnard Free Skin and Cancer Hospital, Sept 30, 1912, on account of an extensive carcinoma of the upper part of the left arm, the result of an extensive burn, which was sustained 15 years ago with kerosene, over back, arms, and face. Present trouble commenced two years ago, when small lumps were noticed on the inner side of the arm in an area which had been grafted with good results. At present there is a large ulcerated area on the arm extending from a short distance above the elbow to within three inches of the axilla, involving the back and outer side of the arm. This was very offensive, edges indurated, glands in axilla enlarged. Pathologic examination of the base of the ulcer gave a typical picture of epithelioma.

The patient made an uneventful recovery and was out of bed on the fifth day (Fig 1). The wound healed primarily throughout. At the time of operation he weighed, with arm, 109 pounds, and two weeks after operation he weighed 133 pounds, and had lost his cachectic look.

CASE II—Male, aged thirty-six years, entered the St. Louis Mullanphy Hospital Nov 26, 1912, with a very painful tumor of the right arm, on account of which the arm was much enlarged from the shoulder to the hand.

Three years ago while playing ball, he hurt the upper arm throwing ball. He paid little attention to it, as it gave him no



Case I —Six days after operation



Case II —Seven days after operation



trouble on the day of injury, noticed after that that he could not throw as well as usual. Never had any trouble with arm until three months after injury, when rowing a boat and working arm vigorously noticed it was not as strong as usual. That night a very severe pain came on. Three or four months later was driving nails when arm began to pain him severely again. Arm never felt weak or lost function up to this time. Three months ago, while taking a bath, noticed a hard lump on the fore part of humerus, which was attached to the bone, very hard, but was not painful on pressure. Always after that pained him more or less all the time. Pain worse at night. Hard mass seemed to get cold, and he would have to keep it in hot packs. Pain of dull, aching, heavy character and limited to upper arm entirely. Never noticed any other constitutional symptoms. One month ago to-day had it operated on. Then noticed severe pain first in forearm and later in shoulder. Pain since operation has been gradually growing worse. Never has noticed any symptoms in any way other than these produced by arm. Has not lost any weight, appetite as good as ever, bowels regular, no fever.

The arm was much swollen and infiltrated from the hand to the shoulder-joint, one-half size larger than normal. The induration of the upper arm was hard and elastic, not pitting on pressure. On the outer and posterior surface of the upper arm, commencing just below the upper insertion of the biceps and slightly behind it, was an ulceration about three inches in length and about a half to three-quarters of an inch in width, this was covered with large, unhealthy granulations slightly elevated above the surrounding surface. This was the result of an incision made for the removal of the tumor before the patient entered the hospital.

Pathologic examination of the arm after removal confirmed the diagnosis of small round-celled sarcoma probably arising from the periosteum, invading the soft tissue of the upper arm, without demonstrable axillary glandular involvement.

In both cases the Berger technic was followed, except that the pectoral muscles were divided near their origin and the clavicle resected afterward. In Case I the clavicle was removed subperiosteally, while in Case II this was not done, and it in no way increased the difficulties of the operation.

In all cases of round-celled sarcoma of the arm, the inter-scapulothoracic amputation of the shoulder should be the operation of choice, as Hasse's<sup>5</sup> histological demonstrations have proved the tendency to metastasis in the muscles. On that account, all muscles attached to the arm should be removed.

If the patient survive, an artificial shoulder and an artificial arm can be so fitted as to hide the deformity and prevent the feeling of lopsidedness which is almost sure to follow and which is very annoying. Neither of my cases has so far felt any inconvenience from lopsidedness. The second case, when in bed, says he feels all of the time as if he would roll over.

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# SOLITARY CYSTS OF THE LIVER.

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SOLITARY cysts of the liver of non-parasitic origin as compared with other conditions found in and about that organ are rare lesions, and there are few cases recorded in the literature on this subject which are identical with the case which I am reporting, as some of the cases reported as solitary cysts have been congenitally dilated gall-bladders or ducts, or cystadenomata, or true cystic livers. They may be either intra- or extrahepatic and vary in size from small shot to large cavities containing several litres of fluid. The right lobe of the liver has been the most frequent site of the cysts in the reported cases and usually the under surface. They have been more common in the female sex, in late middle life. Much discussion has taken place as to the causation of these cysts, but I think the consensus of opinion now is, that they are usually due either to confluence from cystic degeneration or to occlusion of aberrant bile-ducts. Small ones may be caused by degenerative changes in nævi, and larger ones may be due to cystic changes in an adenoma of the bile-ducts. In my case, infarct suggested itself as a possible cause. In a monograph published in 1906 Eli Moschcowitz reviews the literature on non-parasitic cysts of the liver and comes to the following conclusions:

"1 Non-parasitic cysts of the liver are associated with congenital anomalies in other parts of the body, especially with cysts of the kidney

"2 Such cysts of the liver are always associated with congenital anomalies of the liver, consisting in aberrant bile-ducts which may be extra- or intrahepatic

"3 These aberrant bile-ducts are embryonal rests formed in the course of development of the liver and have thus far been found only in cystic liver or livers associated with cystic kidney.



"4 Non-parasitic cysts of the liver have their origin in these aberrant ducts, and may assume two forms one arising from inflammatory hyperplasia of these ducts, the other by retention of fluid in these ducts as the result of congenital obstruction

"5 There is no valid reason for classifying these cysts as tumors"

They have occurred nevertheless without other anomalies being present Cases of long standing are usually surrounded by a firm fibrous capsule, which often contains numerous blood-vessels, and calcareous infiltration may be present. The inner surface is smooth and often ridged and of an opaque white color except where it is very thin walled

The contents vary, but are usually colorless though the fluid may be bile or blood tinged Albumin is present, and in some cases bile pigment, blood, hæmatoidin, cholesterin, and tyrosin have been found Microscopically the capsule is composed of laminated fibrous tissue which may contain bile-ducts, sometimes dilated Occasionally blood pigment is found between the bundles of fibrous tissue The fibrous tissue invades the liver tissue for a short distance and is lined internally with a layer of epithelial cells, which may be columnar or polyhedral in the small cysts

In Bland Sutton's case, which he says is one of the few in which an examination of the cyst wall by a competent pathologist was made, the wall where it joined the liver showed small loculi invested with epithelium and many bile-ducts lined with cubical cells, the main cyst wall consisted of fibrous tissue and its inner surface presented spaces covered with flattened epithelium

In Sharkey's case the capsule of the liver was continuous with both the external and internal surfaces of the cyst wall Thin septa jutted out from the internal surface and a thick cord ran across the cyst, passing at each end into one of the septa. The walls were made up of fibrous tissue with a single layer of flat epithelial cells on the inner surface Cyst was found during an autopsy on a woman aged thirty-eight years, who died of a fractured skull

Corner's case was a woman in late middle life, who for fifteen years had attacks of colicky pain in the right hypochondrium accompanied by vomiting and with radiating pain to the back and right shoulder The clinical diagnosis was distended gall-bladder A cyst four inches in diameter was removed unopened It had been inflamed as shown by the

organized lymph on its surface. The liver substance contiguous to it had also been inflamed and was partly devascularized, hence there was not much hemorrhage attending its removal

McDonnell's case was in a man aged fifty-eight years, who died of peritonitis from a pyloric ulcer. The cyst occupied the mid upper surface of the liver and measured 9.5 cm in diameter, and was adherent to the diaphragm and vena cava. The wall was tough, fibrous white on section, and the contents were thick and of an apple green color. Mucin, blood-cells, and hæmin crystals were present. There were no renal cysts.

Cotton and Burgess report a case in a woman of sixty years in which there were no symptoms. It was the size of an egg and in the left lobe. The liver showed signs of cirrhosis.

Muller's case was in a woman aged fifty-nine years, who had observed the tumor for ten years and had had symptoms for five years. It simulated an ovarian cyst and almost filled the abdominal and pelvic cavities. It was attached to the lower and front surface of the liver and contained six litres of chocolate colored fluid.

Shaw and Elting report a case in a female child aged one and a half years in which the right lobe of the liver was occupied by a globular enlargement extending to the level of the umbilicus. Following puncture and evacuation of 900 c.c. of clear fluid the child died, probably of shock. Partial autopsy showed a thick walled cyst apparently originating in the central portion of the right lobe. All external surfaces were smooth and covered with peritoneum. Gall-bladder distinct. Kidneys apparently normal. Cyst wall consisted of dense fibrous tissue without a lining layer of cells. The inner surface in many places was necrotic and contained fibrin, hemorrhage, and granulation tissue.

Plenk's case was in a woman aged forty years, whose death was caused by a perforated gastric ulcer. A cyst the size of a man's head separated the large right lobe of the liver from the small left lobe extending up to the diaphragm. The wall was lined with cylindrical epithelium with some goblet cells, without cilia, under which was a tissue resembling submucosa, with blood-vessels. Signs of inflammation on the inner surface were probably due to infection from the gastric ulcer by its adhesions. Plenk thought his case to be a cyst of the bile-ducts, which through pressure on the surrounding liver caused atrophy of the left lobe and hypertrophy of the right lobe of the liver.

Hoffman's case was in a woman aged twenty-eight years, who had an enlargement of the abdomen and some pain, no jaundice, no fluctuation. On operation a cyst the size of a man's head occupying the quadrate lobe was found and enucleated. The wall consisted of three layers of connective tissue without epithelial lining, containing rests of liver parenchyma. Hoffman believed his case to be a cystadenoma of the bile-ducts.

Reynold's case was in a woman aged fifty years, movable tumor, no fluctuation. The cyst which originated at the lower border of the left lobe of the liver was first drained with a cannula, two pints of fluid being removed, and the cyst wall was then dissected out.

In Brown's case, which was found during an autopsy on a man aged

sixty-eight years, the cyst was the size of a large orange and occupied the fissure of the suspensory ligament. It was smooth and globular and adherent to the left and quadrate lobes and to the stomach. The walls were thick and showed calcareous plates and the contents were tenacious, bile stained, mucoid fluid. The liver, gall-bladder and other abdominal organs were healthy. Brown says, "It appears to have originated in the accessory bile-ducts that are occasionally found at the left end of the transverse fissure."

Doran's case was in a woman aged forty-two years, who gave a history of injury followed by abortion in a few hours, three years before admission. Four months before admission jaundice began, then occasional vomiting, and enlargement of the liver. Large fluctuating swelling to the right of umbilicus. On operation a cyst was found occupying the quadrate lobe and the whole of the left half of the right lobe. Two and one-half pints of deep green bile were removed by aspiration. Gall-bladder and ducts were normal and the jaundice was probably caused by pressure. In this case Doran suggested that the injury might have caused the rupture of a duct inside the liver, followed by the slow extravasation of the bile into the bruised liver substance around it, thus forming a cystic cavity. (Most authors agree that subcapsular rupture of the liver can lead to cyst formation.) This case, like Mayo Robson's, was entirely intrahepatic.

Aldoas reports a case in a woman aged forty-three years who had had a swelling, which was painless, in the epigastrium for twelve months. On operation, a solitary cyst arising at the free border of the liver was found and twelve pints of thin dark fluid were evacuated. Gall-bladder was normal.

In Winckler's report of Von Glotz's case over 6000 c.c. of fluid were evacuated in two sittings, and autopsy showed a right-sided hydro-nephrosis due to pressure on the ureter from a large cyst of the under surface of the liver.

Konikow's case was in a woman who had jaundice for fifteen years with pain in the liver region and six weeks before admission a swelling. Operation revealed a cyst the size of a child's head attached by a broad base to the right lobe of the liver. The cyst was opened and a part of its wall was resected, while the remainder was sutured. A small sinus persisted for one and a half years afterward. Microscopic examination showed it to be a cystadenoma of the bile-ducts.

As these cysts are not apt to give rise to symptoms until they become of sufficient size to cause pressure, they are usually diagnosed post mortem. They may be mistaken for a distended gall-bladder, cystic liver, echinococcal cyst, gumma, or cyst of some neighboring organ.

The operative results in solitary cysts have been satisfactory and the procedure should be as radical as is consistently

safe, in those cases in which enucleation can be done without excessive hemorrhage, this is the best method, in cases where there are very firm attachments and there are other contraindications, it is best to suture the cyst wall to the parietal peritoneum and drain. Simple puncture is to be condemned.

CASE REPORT.—J L, colored, aged fifty-one years, widowed, mother of seven children. Health fairly good until about five years ago, when she began to have excessive bleeding from a uterine fibroid. In April, 1908, a hysterectomy was performed at the Rutherford Hospital, and a fibroid weighing five pounds was removed together with a cyst of the right ovary which weighed six pounds. At this operation the gall-bladder was inspected and if the cyst was present it escaped detection.

In June, 1911, the patient began to have pain in the epigastrium, which was always worse when the stomach contained food. beyond a slight resistance of the right rectus I could detect nothing abnormal and as the colon was loaded with feces, I advised her to take some castor oil and report herself again.

In December, 1911, the patient returned very much run down and there was plainly visible as well as palpable a small rounded mass in the middle line above the umbilicus, resistant on pressure, and with a distinct transmitted pulsation. Because of the position of the mass and of the fact that it moved with respiration, a tentative diagnosis of tumor of the left lobe of the liver was made and under ether anæsthesia the abdomen was opened on Dec 31, 1911, by a medium incision and the lower border of the left lobe of the liver presented in the wound, showing a firmly encapsulated cyst the size of a small orange.

The surrounding liver tissue was of normal texture. The cystic area was darker, and enlarged veins showed on the surface. The sharp margin of the liver at this point was obliterated and the mass was spherical in outline. At its upper margin and near the centre was a small, firm mass irregular in outline and about 2 cm long by 0.5 cm broad. Except for this the outer surface was perfectly smooth. An aspirating needle was introduced and over 200 cc of almost clear fluid was withdrawn. The remainder was removed by narrow strips of gauze packing. The lining membrane of the cyst was smooth and resembled normal peritoneum. After evacuation of the fluid there was left

a cup-like cavity in the liver which felt more resistant than normal liver tissue. On account of the general weak condition of the patient and the firm and extensive attachment of the cyst it was considered best to suture it to the parietal peritoneum and drain it, which was done, the abdomen being closed in the usual manner.

None of the cyst wall was excised but examination of the fluid removed was entirely negative. It was slightly cloudy, alkaline, specific gravity 1005, and contained albumin. Microscopic examination showed nothing whatever save cellular detritus.

Convalescence was normal and the drainage tract entirely closed in four weeks. Seven weeks later the patient's general health was much improved.

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# GAS CYSTS OF THE INTESTINE.\*

PNEUMATOSIS CYSTOIDES INTESTINORUM HOMINIS.

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INTESTINAL pneumatosis is a chronic, probably a self-limited process, consisting of the formation of gas cysts, which may occupy any layer of the intestinal wall, the gas acting as a foreign body which gives rise to inflammatory changes and leads to the formation of giant-cells

The views of different observers on the origin of intestinal pneumatosis vary widely, and will be considered later on under the headings of the various theories that have been advanced to explain the occurrence of the disease. The majority are in favor of a bacterial genesis, but unless the intercession of additional factors be conceded, this view is weakened by the absence of inflammatory changes, and the disappearance of the characteristic vesicles, after simple laparotomy; last, not least, by the fact that no typical bacteria have as yet been found. The assumption of a mechanical entrance of gas into the tissues presupposes the existence of gaps, or defects, passing from the epithelial layer of the bowel into the interior of the mucosa. This condition has never been positively established; at any rate, an existing communication between the epithelial gaps and the fully developed vesicles can always be constructed as a secondary process, due to the gas contained in the cysts.

In a general way, the emphysematous areas in the intestine have been remarkably free from local ulcerative processes, but practically all the reported cases of intestinal pneumatosis, with detailed clinical histories and autopsy protocols, show the presence of gastric or duodenal ulcers, or at least

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symptoms pointing to some chronic disease of the intestinal tract, which has existed for a number of years (35 out of 44) Of the other cases which we have been able to tabulate, two patients had tuberculous peritonitis, two chronic appendicitis, one carcinoma of the stomach, one pulmonary tuberculosis and emphysema, one volvulus, one post-operative peritonitis, and one suffered from chronic cardiac disease

The following case seems to be of interest, not only on account of its rarity, but because also of the unusual opportunities afforded for bacteriological and pathological examination

The patient, a Chinaman, fifty-seven years old, a laundryman by trade, was admitted to the service of Dr A B Johnson, at the House of Relief on January 18, 1911 He gave a history of indefinite abdominal pain for several months previous His appetite had always been good and he had never vomited, about eight o'clock in the morning on the day of admission, he was suddenly seized with a very severe cramp-like pain in the epigastric region He vomited and his abdomen is said to have rapidly begun to swell At three o'clock in the afternoon, he was brought to the hospital in an ambulance When seen on admission he showed all the symptoms of a perforation of either the stomach or the duodenum, and an immediate operation was decided upon The usual incision was made and on opening the peritoneum a large quantity of gas escaped, and the whole cavity was found to be distended with a serosanguineous fluid, almost clear Over one and a half gallons were removed by the aspirator, and a culture was taken It was then seen that several loops of the small intestine, lying in the right lower quadrant, were matted together and covered by hundreds of small cysts, many of them pedunculated and containing gas When punctured these cysts promptly collapsed with the escape of air Cultures were taken from the interior of these cysts and several vesicles were removed intact for examination A perforated gastric ulcer was found, but as the patient was failing very rapidly, it was thought best to attempt to stop the leak in the stomach with a piece of omentum, upon which a cigarette drain was firmly placed This was done and the wound closed The patient grew slowly weaker, failed to respond to stimulation, and died at eleven o'clock that night

We were fortunate to be able to obtain an autopsy, which was done by Dr Symmers, of the New York Hospital, nine hours after death, a synopsis of which is as follows.

On opening the abdominal cavity, it was found that the parietal peritoneum was diffusely swollen and in places slightly reddish in color, but for the greater part it was pale, lustreless, and thinly covered by fibrinous exudate. There was considerable excess of cloudy fluid in the larger fossæ of the abdomen and pelvis. In the interval between the cardiac end of the stomach and the inner surface of the spleen, a number of soft rice granules were floating free in the fluid exudate. The serosa of the intestines was swollen and opaque, irregularly covered by serofibrinous exudate, and the small gut was thrown into numerous loops, which were matted together by a fibrinous substance. In the right lower quadrant of the abdomen, a dozen or more coils of the small intestine were bound together by serofibrinous exudate, forming a large, convoluted, sausage-like mass, and in the peritoneal covering were dozens of pale, tense bullæ that collapsed on section, with the escape of air. The smallest of these blebs approximated the size of a split pea, while the largest was about the size of a crab apple, and each was covered externally by peritoneum. On exposing the mucous surface of the gut corresponding to the distribution of the gaseous bullæ, large numbers of pin-head sized emphysematous vesicles were found irregularly scattered beneath the epithelial lining, otherwise the mucous membrane showed no noteworthy naked-eye changes. Large and small emphysematous blebs were also observed dispersed through the peritoneum in front of both kidneys.

The stomach was considerably distended by gas and by a quantity of semifluid material, consisting largely of macerated granules of boiled rice. The upper border of the lesser curvature in the region of the pylorus was firmly attached to the under and inner surfaces of the gall-bladder by dense, pale adhesions. In the upper border of the stomach, just to the inner side of this mass of adhesions, was a rounded perforation 1.5 cm in diameter. The perforation involved all the coats of the stomach, and its edges were thin, pale, and smooth. On opening the stomach, an enormous ulcer came into view, involving the upper border of the lesser curvature and the posterior wall of the stomach just to the inner side of the pyloric orifice. It was irregularly rounded and approximated the size of a silver dollar. The base of the ulcer was pale and smooth. In places, the edges were composed of soft, œdematous mucous membrane, which overhung the base of the ulcer in the form of polypoid projections. In other places the edges of the ulcer were thin, smooth, and sloping. The perforation noted in the description of the external aspect of the stomach lay at about the centre of the ulcer in the lesser curvature near the pylorus.

The result of the bacteriological examination, done at the Pathological Department of the New York Hospital, is as follows. A drop of fluid taken from the peritoneal cavity at the time of the operation was inoculated into 100 c.c. of sterile bouillon. At the end of 24 hours the

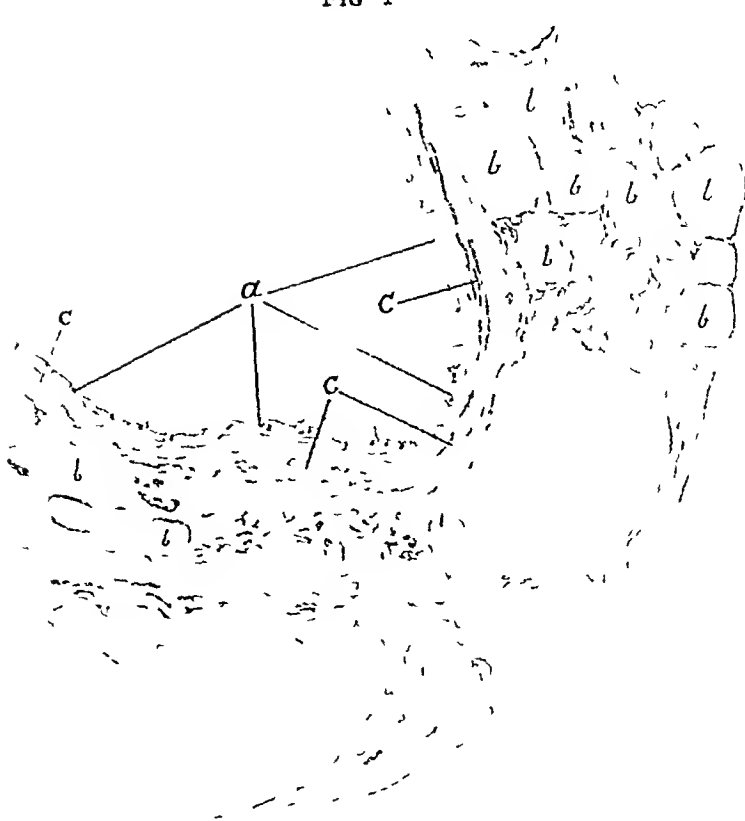


medium was diffusely cloudy. A drop of the growth was then placed on agar and streaked consecutively over the surface of three plates. After 24 hours, the plate showed a growth of *Proteus*, *Bacillus lactis aerogenes* and *Bacillus coli communis*.

Anaërobic cultures, taken on Loeffler's serum from the emphysematous blebs in the peritoneum of the small intestine, showed the presence of numerous large Gram-positive bacilli. The organism was slightly smaller than the *Bacillus lactis aerogenes* of Welch, but belonged to the same family (Dr Elser). It was not practicable to establish the identity of this organism more definitely.

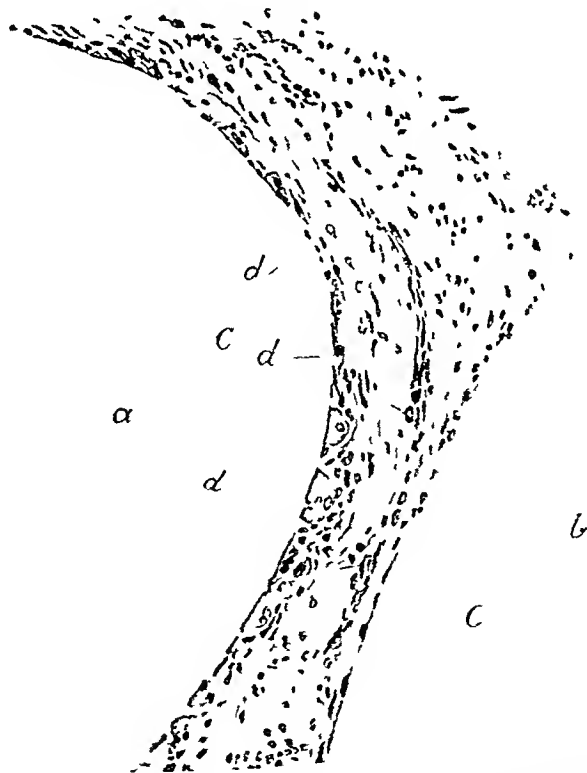
The outcome of the pathological examination was as follows. The mucosa was not in a perfect state of preservation. As far as could be determined, it appeared to be atrophic and very poor in lymphoid elements. The muscularis also was not well developed, and especially the circular coat was thin in places. The cystic process was situated altogether outside of the longitudinal coat and was therefore subserous (Fig 1). The cysts were irregularly oval in shape, some considerably elongated, varying in diameter from about 1 mm to 2 cm. The innermost layers of the wall of the cysts varied somewhat. In some of them, there was a single layer of flattened endothelial-like cells, containing one elongated spindle or ovoid-shaped nucleus, but in such cysts, probably on account of tangential section, a few of the cells presented larger, apparently swollen, nuclei, or were even multi-nuclear (Fig 2). Such giant-cells were particularly noticeable where a slight detachment of the lining had taken place. The exceedingly sharp and linear edge along the inner aspect of the endothelial-like cells in some of the cysts, and the presence of a sharp refractive substance in others, limiting many of the cells internally in the form of short or even quite long crystal-like fascicular bodies, is a curious and unexplained feature. Possibly, the needle-like appearance is due to rupture of a continuous lining membrane.

For the most part, the sections of the cysts were completely devoid of contents, except for occasional stellate and needle-like bodies (see chemist's report). In some places, however, an irregular zone of slightly granular substance, staining deeply with hæmatoxylin, adhered to the lining of the cyst, but usually occupied only a very small part of the cavity. There were no cellular elements in this substance, except those detached from the cyst wall. Another type of cysts showed a lining in which the cellular elements seemed to have suffered from marked com-



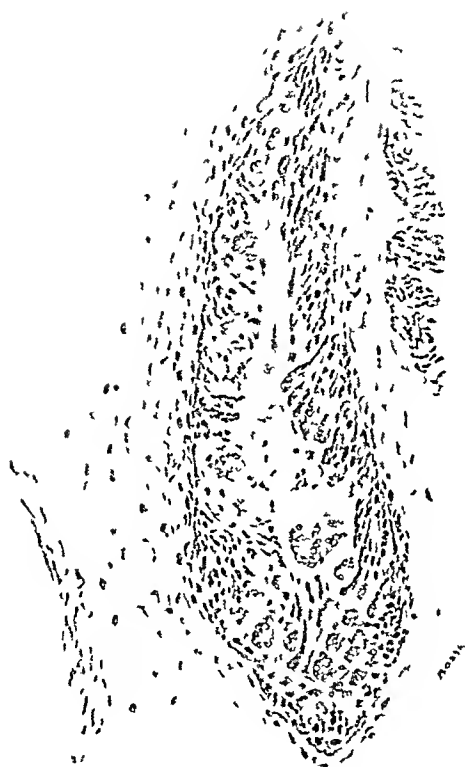
Low power Transverse section of gut showing subserous disposition of the gas  
*a* mucous membrane, *b* subserous cysts, *c* attenuated muscularis

FIG 2



Illustrating the typical lining membrane of a gas cyst. The space to the right is bounded on the left by a connective tissue septum bearing endotheloid and giant multinucleated cells whose flattened inner aspect is characteristic, *a* giant-cell lining, *b* connective-tissue septum, *c* interior of cyst *d* sharp edge

FIG 3



Typical giant-cell focus    Such areas may at first sight suggest a vein    Note the giant-cells in the lumen

FIG 4



Showing general appearance of involved part of small intestine



pression, so that only an occasional nucleus with a faint, long-drawn-out spindle-like body remained as evidence of the cellular nature of the lining membrane. In such cysts, however, the endothelial nature of the cells became apparent in those places where a tangential section brought more of their bodies into view. Here the atrophic effect of pressure was seen in the small size of the nuclei.

These cyst linings may be regarded as having cells of an intermediate type in which the lining is made up of elements that vary greatly in size and shape, in places being of an endothelioid type, in others having a polygonal shape, and in still others being giant-cells with two or more nuclei.

In the connective-tissue septa between the larger cysts, channels were found whose walls at first sight gave the impression of belonging to a vein or large lymphatic. These were lined with a membrane composed of a large number of giant-cells (Fig. 3). The lumen of the channel contained detached giant-cells. The mixture of small round cells, of spindle-cells, and the partial liberation of giant-cells from the walls made a somewhat confusing picture. Doubtless such appearances are due in part to tangential sectioning and to the desquamation incident upon imperfect fixation. In such channels, there is a marked proliferation of spindle- and endothelial cells, and they lie intermingled with the giant-cells.

The outer walls of these giant-cell channels, when thin, were composed of a number of layers of spindle-shaped cells simulating smooth muscle. The arrangement of the cells in a concentric fashion around the lumen of the channel, although for the most part fairly distinct and easily differentiated from the surrounding connective tissue, was not always prominent enough to warrant considering it a true theca. In many instances, the cellular elements in the surrounding connective tissue and the young connective-tissue elements, probably of an inflammatory nature, with numerous round cells and polynuclear leucocytes, encroached upon these giant-cell foci, making the recognition of a limiting wall almost impossible.

This proliferative, and in part inflammatory process had led to a marked thickening of the walls of these giant-celled channels. Here, collections of endothelial round cells and polynuclear leucocytes disposed with their long axis pointing toward the centre of

the focus were found, giving an appearance simulating the walls of a tubercle. The giant-cells can best be studied in those channels, for they often filled them, being completely detached from the walls. They presented a multitude of different shapes, there being as many as one or two dozen nuclei, usually occupying a median position in the cell. Besides this, polynuclear leucocytes were found in abundance between the giant-cells.

Where the section took in only the outer layers of these foci, the inflammatory zone can best be studied. In such places, collections of polynuclear leucocytes, round cells, plasma cells and epithelioid cells were found.

In the larger septa of connective tissue there were foci, which probably represent stages in the obliteration either of cysts or of giant-cell channels. These showed a peripheral zone of rather dense connective tissue, relatively poor in cells, the cellular elements being arranged in a radial fashion. Within this layer was enclosed an inflammatory nodule, containing numerous leucocytes, endothelioid cells, and a few giant-cells. Perhaps this is indicative of a healing process. The conversion of the loose connective tissue into dense fibrotic nodules and bands, such as form the outer zone of the focus described, was regularly seen in some of the sections, indeed, so much so, that veritable fibromata formed the striking feature of some of the sections. Thus, as an end result of the inflammatory and cicatrizing process, there were areas in which the cysts had become relatively few in number, as evidenced by the remarkable thickening of the septa. In the septa there were large fibrotic nodes made up of the connective tissue already described, in places undergoing a mucoid degeneration. A careful study reveals the fact that even these microscopic fibromata were the results of connective-tissue proliferation and obliteration of cysts, for an irregular space could often be detected in their centres. Even in the neighborhood of the nodules there were small collections of atrophic giant-cells, small polygonal cells, and endothelioid cells.

Sections of the gut taking in the mesenteric border and a portion of the mesentery showed typical cyst formation, with quite a marked inflammatory process in the connective-tissue septa. The cysts could be traced for a short distance into the mesentery, where their structure was the same as in the intestine. There was marked atrophy of the muscular coat, mucosa, and lymph follicles where cysts were present.

4 Evidences of dilatation of lymphatics and of the inter-communication of large lymphatic spaces, possibly cyst spaces with undoubted lymph channels

5 Absence of communication between cysts

6 Inflammatory and productive processes between the cysts and under the peritoneum, resulting in the formation of connective tissue and fibromatous masses, leading to the obliteration of certain cysts and therefore to a kind of healing process

7 Absence of bacteria in most of the cysts (The bacteria present in some places are probably post-mortem invaders)

8 The deposition of highly refractive needles (see chemist's report) in the interior of many of the cysts, causing a peculiar flattening of the cells belonging to the lining membrane, and the possible rôle of such crystalline matter, in the production of some of the giant-cells

*Chemist's Report*—The crystalline matter removed from the gas cysts is found composed of needle-shaped, translucent, homogeneous crystals, arranged loosely in sheaves. They are soluble in chloroform and ether, from which they readily recrystallize, assuming irregular, branched, crystalline forms. After treatment with dilute mineral acid and extraction with chloroform and ether, on evaporation of solvent the dissolved material fails to crystallize. There was not sufficient material for closer study, but the above would seem to justify the belief that the crystals represent soaps of the higher fatty acids.

The formation of small gas cysts in the intestine of animals has been known for a long time past. The disease was first described by Mayer, in 1825, in an otherwise healthy hog. The gas contained in the vesicles was found on analysis to resemble the atmospheric air. After the account of the disease by Mayer, the first description of the microscopical appearance in pigs was contributed by Roth, in 1896, who assumed a primary proliferating lymphangitis, with secondary excretion of the gas from the blood. After him, Schweitzer, in 1899, and Heydemann, in 1904, claimed that these animals always had intestinal catarrh with obstruction, causing a considerable accumulation of gas, which is under a high pressure, and is pressed into the lymphatics through small solutions in the continuity of the mucosa, thus forming cysts, and lymph-



sists in the benign course of the two affections, their prolonged duration, and their dependence upon predisposing factors

The origin of gas cysts of the intestine was referred by von Winckel to hæmatomata or to follicles and small glands. Hemorrhage was considered as the cause by Lebedeff. In the opinion of Chiari and Eppinger, the air entered the cysts from the outside, whereas Bang<sup>1</sup> claimed that the lymph is transformed into gas under the influence of giant-cells.

After a thorough study of his personal observation, by means of all known laboratory adjuvants, and careful sifting of the available evidence derived from other cases, it appears to the author that, taken by itself alone, neither the bacterial nor the mechanical theory satisfactorily explains the formation of these gas cysts of the intestine. Acting in conjunction, it becomes more plausible that this peculiar condition might develop in consequence of bacterial invasion, supplemented by mechanical minute solutions of continuity. Reasoning along the same lines, the presence of chemical factors suggests itself as a possible ally, in the complicated pathogenesis of this interesting affection.

*Bacterial Theory*—This theory is endorsed by the majority of authors, who agree in referring the formation of the cysts to the action of gas-producing micro-organisms. There is much to be said in favor of this view, although it has not yet been placed on a positive basis. Its opponents claim that the bacterial findings are always debatable, and the results either of post-mortem change, or of a secondary bacterial invasion.

The first to arraign a coccus as the originator of emphysema (vaginal) was Klebs, in 1876, and this explanation was extended to gas formation in the intestine, by Eisenlohr,<sup>2</sup> 1888. Three years after him, Camargo<sup>3</sup> reported similar bacterial findings, in a case of true pneumatosis cystoides intestinorum. The rods which Winands,<sup>4</sup> 1895, was enabled to demonstrate inside and outside of the cysts were not accepted by the investigator himself as satisfactory evidence of a bacterial pathogenesis.

A French observer, Dupraz,<sup>5</sup> claimed to have furnished the original and complete proof of the bacterial theory, through his demonstration of a microbe which presented certain resemblances to the lactic ferments

3 Absence of all inflammatory signs in the tissues or in the cysts themselves

4 Negative bacterial findings on culture as well as in sections

5 Combination of intestinal pneumatosis with certain chronic gastric affections, which favor meteorism and lower the resistance against the escape of intestinal gas into the bowel wall

6 Complete disappearance of the gas cysts, after simple laparotomy or enterostomy

7 Similarity of experimental gas cysts, in rabbits, and human pneumatosis, both in appearance and histological findings

8 Necessity for the combined action of several causative factors, in the experimental production of intestinal pneumatosis

Changes in the lymph vessels are undoubtedly present in practically all these cases, and were already credited with a leading part in the production of intestinal pneumatosis by Winands,<sup>5</sup> 1895

Kolli,<sup>8</sup> 1898, explained the cysts as perhaps due to the forcing of the gases in the stomach, during the act of vomiting, through the margins of a gastric ulcer into the loose subserous cellular tissue of the intestinal canal, where, for some reason, the gas failed to become absorbed Verebely,<sup>17</sup> 1901, assumed that the gas had escaped through fine solutions of continuity in the intestinal wall For the explanation of the gas bubbles in his case, Thorburn,<sup>19</sup> 1903, suggested that the gas was driven from the stomach into the omentum through a perforation and for some reason became encysted instead of being absorbed In the opinion of Simmonds,<sup>44</sup> 1910, a lesion of the gastro-intestinal mucosa is indispensable to the entrance of gas-forming bacteria into the bowel wall Urban,<sup>45</sup> 1910, explained the condition as the outcome of cystic dilatations of the lymph gaps and vessels, but left it an open question how the air enters into the cysts, apparently through minute lesions of the intestinal wall Mori,<sup>29</sup> 1908, abandoned the idea of a bacterial origin in favor of a mechanical explanation, such as circulatory disturbances Ciechanowski<sup>46</sup> noted the absence of bacterial agents in his first observation, and pronounced himself more definitely in favor of the mechanical theory in his recent contribution (1911), admitting, however, that the penetration of the gases into the tissue under the action of purely mechanical factors has never been unobjectionably demonstrated

The adherents of the mechanical theory, as was pointed out by Nowicki,<sup>34</sup> 1909, are found mostly among veterinarians, who believe that in animals the gas penetrates into the mucosa through solutions in the continuity of the epithelium, especially on injuries from overstraining at work or lesions due to the presence of foreign bodies As the process is often found associated with enterocatarrh, the gas has been assumed to enter the lymph gaps in consequence of the increased pressure within the bowel Very hot or starchy fodder has also been

give rise to a marked increase of the coli aerogenes flora in the intestine, with transformation of the ordinary type into especially dangerous gas producers. It is usually a lack of lactic acid bacteria in the milk which causes a proliferation and over-activity of the ubiquitous colon bacillus. A possible formation of the gas from the blood of the vascular structures was taken into consideration by Hibler, and Deutsch, in the discussion of Verebely's<sup>17</sup> case, suggested that the gas might originate through the protoplasmic function of the cells, instead of coming from the bowel wall itself, as, for example, the way in which gas develops in the cells of ripening apples, while no such gas is found in unripe fruit.

Bang claimed that the lymph is transformed into gas under the influence of giant-cells. More recently the origin of the giant-cells has been sought in the local irritation of the endothelial lining, by the gas contained within the cysts (Ciechanowski,<sup>47</sup> 1911)

#### NATURE OF THE GAS CONTAINED IN THE CYSTS

It has been pointed out by Jaeger that examinations made on specimens that are not perfectly fresh are of no value, for the reason that a gaseous exchange with the atmospheric air takes place through the vesicular walls. In order to be satisfactory, the examination must be completed within three hours at the latest. The mixture obtained by him was as follows (*Verhdlg d dtsh Ges f path Anatomie*, Stuttgart, 1906-1907) CO<sub>2</sub>, 15 per cent, O, 5.6 per cent, H, 73.3 per cent, N, 6.1 per cent.

The chemical analysis of the gas in Urban's case, which was made in the Vienna University Laboratory for Medical Chemistry, led to the following findings: CO<sub>2</sub>, 52.3 per cent, marsh gas, 7.66 per cent. Two months previously, the examination of a specimen derived from the same case, in a chemical laboratory in Luz, Austria, had shown the following composition of the gas: CO<sub>2</sub>, 4.5 per cent, O, 15.4 per cent, nitrogen and hydrogen (marsh gas?), 80.1 per cent. The gas was considered as trimethylamin, by Zweifel, whose material was derived from a case of emphysematous vaginitis (*Archiv f Gyn*, vol 111, 1877).

The first positive case was reported by Bang in 1876, this was followed by Eisenlohr's case in 1888. Hahn, after whom intestinal pneumatosis is often called in Germany, was the first to treat a case by laparotomy in 1899. Then Ciechanowski states that in 1904 he was able to find 20 cases in the literature.

they were infiltrated with round cells. The inner surface of the cysts was provided with a lining of flattened endothelial cells, multinuclear giant-cells were also found scattered about. A connection of the cysts with the lymph vessels or lymph spaces could not be demonstrated. Numerous bacteria were found throughout, both inside and outside of the cysts.

4 KOUSKOW (*Boln Gaz Botkina Russ*, October 7, 1891) At the autopsy of a man 57 years of age, who had suffered for years from symptoms of gastric ulcer and intestinal obstruction, several coils of the small bowel were found to be covered with a transparent cyst-like tumor. Gas escaped on incision of the membranous lining, which was found to be the shell of a number of separate cysts, varying in shape and size. Each small vesicle had a connective-tissue wall, lined by a membrane made up of flattened multinuclear giant-cells.

5 WINANDS, M (*Ziegler's Beitrage zur Pathol Anat u zur allgem Pathol*, vol xvii, 1895, p 38) The observation concerned a woman 49 years of age, who was for six years an inmate of the Marburg Clinic, under the diagnosis of chronic ulcer of the stomach. Intestinal puncture was performed on one occasion, on account of persistent obstipation and associated extremely severe tympanites, after temporary improvement, the patient succumbed to progressive exhaustion. At the autopsy (44 hours postmortem), a very peculiar change was found in the abdominal cavity, aside from the fundamental disease. The intestinal wall contained countless numbers of gas cysts, which were likewise scattered over the lining adhesions.

6 ORLANDI, E (*Gazzetta Med di Torino*, No 40, 1896, p 781) The patient, a man 33 years of age, was admitted to the hospital with symptoms of intestinal occlusion and alcoholic delirium. Temporary improvement was followed three days later by peritonitis and death. The autopsy showed, aside from fibrinous peritonitis, a number (7-9) of irregularly arranged swellings, up to the size of a nut, at Bauhin's valve. These cysts had the appearance of submucous neoplasms, and were of an elastic consistence, a large quantity of gas, without offensive odor, escaped on incision of the swellings. The intestinal mucosa presented no special changes.

Cultures were prepared from all these gas cysts, and a bacterium was obtained, in one instance even in pure culture, which gave rise to gas development also outside of the body. Rabbits, mice, and guinea pigs were killed by injections with this bacterium, but the autopsy yielded no characteristic findings, and no gas formation in the animal body was demonstrable in further experimentation.

7 DUPRAZ, A (*Archiv de Méd Expérin*, vol ix, 1897, p 282). The observation concerned a woman 29 years of age, at whose autopsy (36 hours after death) the stomach was found to contain submucous vesicles in the large cul-de-sac, while other emphysematous vesicles covered the jejunum for some distance, as well as the ileum. The microscopical findings showed a dilatation of the lymphatic system, with formation of alveoli, with gaseous contents. The smaller alveoli presented

gastric dilatation, due to cicatricial pyloric stricture, the small intestine was found to be covered with numbers of gas cysts, from the size of a pinhead to that of a hazel-nut. Another cluster of gas cysts was seen on the diaphragm near its centre. The cysts were neither removed nor interfered with in any way by the operator.

13 TOLOT (*Lyon Medical* 1901, vol xcvi, p 955) In the course of a laparotomy on a man 52 years of age, with cicatricial pyloric stenosis, a large number of cysts were discovered on the peritoneal surface of the small intestine. No cysts were seen on the transverse colon, but several vesicles, some of them with a pedicle, appeared on the lower surface of the diaphragm. The intestinal cysts varied in size between that of a currant and a gooseberry, they were transparent and apparently situated underneath the serosa. Notable improvement followed upon the simple exposure of the cysts to the air, combined with digital dilatation of the pylorus.

14 VALLAS-PINATELLE (*Lyon Medical*, vol xcvi, 1901, p 215) The patient, a man 48 years of age, was operated upon as an emergency procedure under symptoms of acute intestinal obstruction or perforative peritonitis, death on third day following operation. The autopsy, 30 hours after death, showed the presence of a peculiar tumor, the size of two fists, a polycystic structure resembling a hydatid mole, which occupied a circumscribed segment of the jejunum. Clusters of cysts were found arranged along one metre's distance, followed by isolated cysts on the next metre of the bowel, the remainder of the ileum and the entire large intestine were normal. The vesicles varied from the size of a pea to that of a large nut. An odorless gas escaped on puncture or compression. The walls were thin and transparent, but continuous, and the gas could not be squeezed into the intestine, nor from one cyst into another. There was no cadaveric putrefaction. Some of the cysts were also noted on the parietal peritoneum and on the diaphragm.

Histological examination showed that the cysts were subserous and had very thin walls, made up of a connective-tissue stroma apparently devoid of endothelium, and with a very variable vascularization.

15 PELNAR (*Bull Int de l'Acad de Med*, vi 1901) This observation was made in a case of chronic tuberculous peritonitis. The cysts were mostly found in the intestinal submucosa, and were without an endothelial lining. The peritoneum presented no gas-cyst formation.

16 MIWA (*Centralblatt für Chirurgie*, No 16, 1901, p 427) At the autopsy of a man 42 years of age, countless vesicles were noted on the ileum, as the most noteworthy change, a segment of bowel about 30 cm in length was studded with a number of gas cysts, from the size of a hempseed to that of a pigeon's egg, considerably narrowing the lumen of the intestinal canal. These cysts were all attached by a broad base, on compression they burst with a loud report. The gas contained in the cysts was odorless and non-combustible.

Microscopical examination showed no characteristic bacteria in the vascular contents. Although gas was formed in sugar cultures, animal

vesicles, round or oval, from which escaped an odorless non-combustible gas, were found on the mesentery and on a coil of small intestine, about 30 inches long. At the autopsy, three weeks later, no trace of the cysts was left on the intestine or on the mesentery.

The microscopical examination showed that the cysts had a connective-tissue wall and an endothelial lining.

21 v HACKER (*Wiener klin Wchschrft*, Nos 12, 14, 1903, pp 368, 430) Before the Innsbruck Scientific Medical Society, meeting of January 17, 1903, was shown a man 42 years of age, upon whom an exploratory laparotomy had been performed on account of obscure intestinal disturbances. Aside from a gastric ulcer at the fundus, multiple gas cysts, from the size of a hempseed to that of a pigeon's egg, were found on several portions of the small bowel, chiefly occupying the convexity. Individual groups of these partly pedunculated structures were removed for examination. The vesicles burst on pressure with a slight report, and contained a colorless, odorless gas.

The histological examination, by Hibler, showed that the gas cysts were lined with a single layer of endothelial cells, similar layers were likewise found in gas-free serum-filled spaces. There were no recent inflammatory changes, no giant-cells, and no necrotic areas.

22 CIECHANOWSKI (*Wiener med Wchschrft*, No 1, 1904, p 24) Gas cysts of the intestine were found at the autopsy of a woman 24 years old, who had died from gastric hemorrhage. The ileocæcal region was occupied by three swellings, attached to the side of the ileum opposite the insertion of the mesentery, and composed of numerous large and small gas cysts. The vesicles were filled with a colorless and odorless gas, in size, they varied from that of a pinhead to a pea. The inner surface was smooth and glistening, there was no apparent communication between the cysts.

Histological examination showed the cysts to be mostly situated in the thickened subserous tissue, in part outside of the external elastica of the bowel wall, which presented gaps in these localities. The submucosa contained cysts in only a few isolated areas. Careful microscopical and bacteriological examinations served to show that no etiological part was played in this instance by bacterial agents.

23, 24 STORI (*Clinica Moderna*, Pisa, x, 1904, p 481) Case I In the course of operation upon a woman 38 years of age (gastro-enterostomy for pyloric stenosis and gastric dilatation) a round mass consisting of transparent cysts from a pinhead to a bean in size was found lying above the gastrohepatic ligament. The cysts contained an odorless non-combustible gas. Part of the mass was removed for examination, and the cystic walls were found to be made up of connective tissue lined with a layer of endothelial cells.

Case II In the course of operation upon a man 30 years of age (gastro-enterostomy for pyloric stenosis) the ileum near the cæcum was found to be surrounded for about a metre's length by a greyish lobulated mass, springing from the mesentery, and made up of separate transparent cysts, from the size of a pinhead to a small hazel-nut. The cysts con-

dyspeptic symptoms developed and became gradually worse, leading to marasmus and death after protracted gastric hemorrhage of several days' duration. At the autopsy the ileum was seen to be covered for about the distance of one metre with innumerable cysts, up to the size of a bean, forming grape-clusterlike projections or floating like simple vesicles on a long slender pedicle. The cysts were all attached to the free margin of the bowel as far as the mesenteric insertion, but without involving the mesentery.

The microscopical examination showed the absence of gas cysts from the intestinal mucosa, which was unchanged, whereas the submucosa and also the thickened serosa contained numerous gas cysts, lined with a more or less distinct endothelium and surrounded by a layer of connective tissue. The submucosa also contained collapsed cysts with numerous enclosed cells, mostly lymphocytes, and many large multinuclear giant-cells. Apparently a communication existed between the lymph vessels and the cysts.

33 FINNEY, J. M. T. (*Journ Am Med Assoc*, Oct 17, 1908, p 1291)  
In the course of operation upon a man 60 years of age (gastro-enterostomy as a palliative procedure for the relief of suspected carcinoma), "a curious soft multinuclear cystic tumor, 15 cm (6 inches) long by 8 cm ( $3\frac{1}{4}$  inches) wide at its widest point, was found attached to the free border of a loop of ileum about one foot above the ileocaecal valve." The cysts were very numerous and varied from microscopical size to that of grapes, each cyst seemed to have a thin fibrous wall of its own, which burst on puncture with an audible noise, indicating considerable pressure. The gas contained in the cysts was odorless and non-combustible. Portions of the mass were removed for histological examination, and were found to be composed of a loose fibrous tissue surrounding spaces of very irregular size, part of which were provided with an endothelial lining and multinuclear giant-cells. The endothelial cells as well as the cells of the adventitia presented swelling or ballooning, and numerous cells apparently belonging to the connective tissue were similarly enlarged and filled with great vacuoles, lending a very loose appearance to the entire tissue.

34, 35, 36 NOWICKI (*Virchow's Archiv*, vol cxcviii, 1909, p 143)  
(1) At the autopsy of a man 22 years of age, who had died from valvular disease of the heart and chronic gastro-enteritis, the following condition was noted in the large intestine. The mucosa of the transverse and descending colon showed transverse elevations up to the size of a nut, separated by deep furrows, these elevations, to some extent also the smooth mucosa, were studded with greyish, transparent, round gas vesicles, of an average size of 3 mm. A characteristic crepitation was heard on compression or incision. The vesicles did not change in position under pressure. On removal of a slice of the uppermost layer, the bowel presented a sponge-like appearance, while the outer surface, *i.e.*, the intestinal serosa, was smooth and free from visible changes.

(2) At the autopsy of a man 41 years of age, who had died from chronic myocarditis and chronic gastro-enteritis, similar findings were noted as in the preceding case, in form of cystoid pneumatosis of the

that of a hempseed to that of a hazel-nut, some were sessile, others were pedunculated, all were tense, and their contents were evidently gaseous, the cysts collapsing on puncture. None of them contained fluid, but one or two were filled with altered blood clot. The cysts occupied altogether about 54 inches of the ileum, a line of similar but smaller cysts was found on the under surface of the transverse mesocolon, in the hepatic flexure, a few cysts were scattered over the under surface of the transverse colon about its middle, the jejunum was free from cysts and so was the large intestine, except the parts mentioned. The cysts in the lower end of the ileum were evidently of longest duration, the vesicles becoming less numerous, less prominent, and apparently of more recent age, in an upward direction.

On microscopic examination, the cysts were found to have developed in the submucous coat and on the serous surface. Large giant-cells were observed in the innermost layer of the cyst wall, with fairly distinct margins and many nuclei.

42 WIESINGER (*Centralblatt für Chirurgie*, No 16, 1910, p 577) A specimen of gas cyst of the bowel wall, obtained at an operation for ileus, from a woman 67 years of age, was presented before a surgical society. A movable tumor the size of a small fist had been palpable above the umbilicus, and was found connected with the ileum at the operation. Another coil of small intestine was adherent to the tumor and was bent at a sharp angle. One coil was resected, and the other had a piece excised from its wall. The tumor was found to be cystic but contained air instead of fluid. Recovery.

43 ARZT, L (*Frankfurter Zeitschrift f Pathologie*, vol vi, Feb 1, 1910, p 85) The patient was a man 30 years of age, who had suffered from gastric disturbances since 1906. The condition gradually became aggravated, and laparotomy was performed in January, 1909. After the peritoneum had been opened in the middle line between the xiphoid process and the umbilicus, the entire visible portion of the abdominal cavity was seen to be filled with large and small vesicles, between the size of a cherry and that of a hen's egg, studding the great omentum. Vesicles of the same character were seen also in the serosa of the small intestine, being especially numerous at the side of the coils opposite the insertion of the mesentery. These vesicles, which were filled with gas, could be removed by blunt dissection. After the ablation of a large number of the vesicles, a posterior retrocolic gastro-enterostomy was performed, and the abdominal wound was closed. The further course was unimportant, the patient was discharged cured three weeks after the operation, the improvement persisted one year later.

Principal results of the histological examination (1) formation of cysts, single or multiple, in the intestinal wall, in the subserous tissue, with transformation of the endothelial lining into giant-cells in isolated areas, (2) undoubted lymph capillaries, with the lumen almost entirely obliterated by numerous giant-cells, developed in part at least from the endothelium of the lymph capillaries, (3) slit-like or rounded cavities



istics of simple as well as cavernous angioma. Beside and between the blood lacunæ were seen cavities of variable size, rounded shape, and cystic appearance, lined with a layer of flattened endothelial cells. These cavities were for the most part empty, some contained individual more or less well-preserved blood elements and blood pigment.

47 CIECHANOWSKI (*Virchow's Archiv*, vol ccm, 1911, p 170) The patient was a woman 46 years of age, who died in the hospital under the diagnosis of pulmonary tuberculosis and emphysema, without having presented any special symptoms on the part of the intestine. The autopsy showed pneumatosis cystoides, limited to the large intestine, the changes began directly at the ileocæcal boundary, comprising without interruption the entire cæcum, ascending and transverse colon, reaching as far as 10 cm below the splenic flexure, where they terminated very abruptly. The colonic mucosa in the affected segments was uniformly bloated by gas cysts in the submucosa, which was interspersed with innumerable vesicles from the size of a pinhead to that of a pea. The contents of the cysts consisted of a colorless and odorless gas.

The microscopical examination confirmed in a general way the macroscopical findings, showing the submucosa to be the main seat of the gas cysts, whereas the subserosa was unchanged. Collections of giant-cells, surrounded by cellular connective tissue, were found in cyst-free upper layers of the submucosa, above the deeper cystic layers.

48 MIYAKE (*Archiv f klin Chir*, vol xcv, 1911, p 437) The patient was a physician 45 years of age, who during the last seven years had four attacks of acute and very severe pain in the ileocæcal region, and two similar attacks in the left iliac fossa. Radical operation was performed under the diagnosis of chronic recurrent appendicitis. Beside this disease, pneumatosis was discovered, affecting a coil of the ileum, and exactly corresponding to a resistant spot in the umbilical region. The coil of ileum, about 10 cm long and at a distance of 338 cm from the duodenojejunal fold, was studded with a mass of gas vesicles, from the size of a lentil to that of a pea, arranged like grape clusters, mostly attached with a broad flattened base, in part pedunculated. The vesicles were either transparent, bluish, or pinkish in color, in part traversed by a fine vascular network. Beginning at the insertion of the mesentery the conglomeration of gas cysts covered about three-fourths of the circumference of the intestinal tube, leaving one-fourth of the bowel uninvolved, on the side opposite the insertion of the mesentery. The vesicles burst on compression with an audible report, the gas contained in them was odorless and non-combustible. The remaining intestinal segments were found to be free from vesicles on careful inspection of the exposed coils. The coil of ileum affected with the pneumatosis was resected to a length of about 10 cm, this was followed by circular junction of the two stumps. The patient made a prompt and very good recovery.

49 ELSE PHILIP (Inaugural Dissertation, Leipzig, 1911) The patient, a carpenter 23 years of age, was under conservative treatment two years ago for perityphilitis. Eight days before admission to the clinic he was

likewise found on the internal side. Some of these swellings were so tensely stretched as to obliterate the lumen of the bowel. These swellings were therefore true emphysemata.

The observation of Cloquet (*Bulletin de la Fac de Méd*, vii, quoted by Andral, *Anatomie Pathol*, ii, p 175) can likewise not be admitted as a true case of intestinal pneumatosis.

A scrofulous patient, 20 years of age, died from vertebral caries in a state of extreme marasmus. At the autopsy soon after death, the cadaver presented no evidence of putrefaction. The cellular tissue between the various layers of the stomach was found to be very emphysematous, its walls appeared to be inflated, and in several places were nearly as thick as the thumb. The roughened mucosa was pale, and without a demonstrable lesion. The two anterior layers of the great omentum which are inserted at the greater curvature of the stomach were likewise separated by air. Similar conditions prevailed in the two layers of the lesser omentum. Collections of gas resembling the above were noted in other portions of the submucous cellular tissue, especially in the wall of the gall-bladder.

The treatment of this condition is the treatment of the fundamental or predisposing disease. Hahn, at the time of operation on his case, found the involvement of the ileum and colon so extensive that removal of the diseased bowel was considered impossible, so a number of the cysts were compressed between the fingers and ruptured. The patient made a good recovery after simple laparotomy and was considered cured seven weeks later. Mori states that in his case the patient after gastro-enterostomy was considerably improved, but suffered a relapse of his symptoms eight months later, which necessitated a second operation. At this time, the large number of cysts observed at the first operation had entirely vanished, except two small hydatid vesicles with serous contents. Kadyan had the opportunity of two secondary laparotomies on his case, the first two and a half months, the second four and one-half months after the first operation. At each time he noticed the number of cysts to be greatly diminished, practically none remaining at the third operation. Nigrisoli in the course of an operation for pyloric stenosis found many cysts on the small intestine. These were not interfered with, and at the autopsy three weeks later they had entirely disappeared.

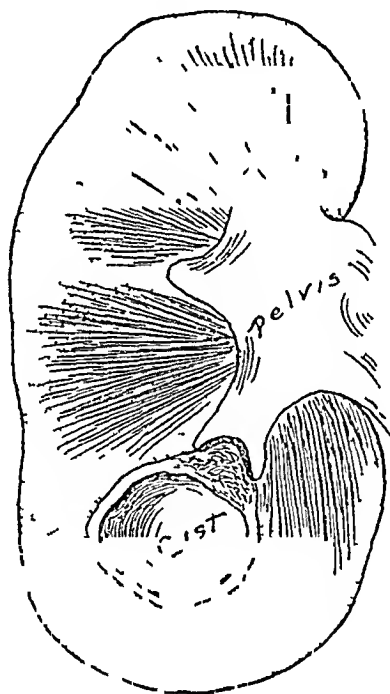
ically, many r b c, w b c, epithelial cells, occasional hyaline cast, no granular casts, many colon bacilli Urea 15 grams to the litre

*Rectal Examination*—Prostate moderately enlarged, distinctly indurated, particularly the right side Slightly tender Median furrow and notch shallow Both seminal vesicles indurated There is no intervesicular plateau There are marked adhesions on the right side between the upper pole of the prostate and seminal vesicle and the lateral pelvic wall The membranous urethra and rectum negative No enlarged glands in the sacral fossa "Prostatic secretion" contains a great many red blood cells, pus cells, and a few inactive spermatozoa Stained specimen showed colon bacilli Patient was put on hot rectal douches, rest, urotropin, and water in abundance Two days later a cystoscopic examination was done with the following findings Catheter passed easily Recovered 250 c c of bloody residual urine Bladder capacity 600 c c Cystoscope entered easily Showed a definite rounding in the median portion of the prostate, amounting almost to a lobe, from the margin of which blood could be seen oozing quite freely, internal orifice otherwise normal Both ureteral orifices normal in appearance and seem to be ejecting clear urine at normal intervals Bladder wall normal, no stone, ulceration or trabeculation With finger in rectum and cystoscope in the urethra, there was found slight thickening in the region of the median portion of the prostate

Bleeding diminished slightly, and several days after the cystoscopic examination, the patient was endoscoped There was found a large, dark-red, bleeding verumontanum and the whole posterior urethra extremely congested Orifice of the utricle suggests nothing normal In the light of the findings so far, it was thought that the symptoms were probably all of prostatic and vesicular origin, and that the pain in the right kidney region was one of the referred pains of prostatitis simulating renal colic However, the patient several days before I saw him had been radiographed, and a shadow was found in the bony pelvis low down on the right side with the probable diagnosis of ureteral calculus Kidneys were pronounced negative In view of this, it was thought best to catheterize the ureters This was done, and both catheters passed directly to the renal pelvis without obstruction and withdrew perfectly clear urine The bladder

usual manner, owing to fibrous tissue changes. Upper pole opened easily and normally. Bleeding was slight, mostly from the lower portion. On opening the kidney, a rounded mass, the size of a walnut, presented in the region of one of the lower pyramids. By placing the hands on either side of the pelvis and invaginating it, it was found that the mass was a cyst which corresponded to one of the pyramids, and that the tip of the papilla was incrustated with the calcareous material shown in Figs 1, 2, 3. The cortex in this region was denser than the re-

FIG 1



maining part of the kidney cortex and corresponded to the area drained by the papilla. There were no visible cysts in the cortex, but the kidney in this region was very sclerotic. The cyst was easily shelled from its bed, which was quite unexpected, and its attachment to the pelvis was cauterized with the Paquelin cautery. There were no signs of malignancy. The kidney was closed with interrupted mattress sutures of chromic catgut. Cigarette drain down to the kidney, wound closed in layers, except for the drain space. Skin closed with interrupted fine black silk. Silver foil dressing. Patient stood the operation well.

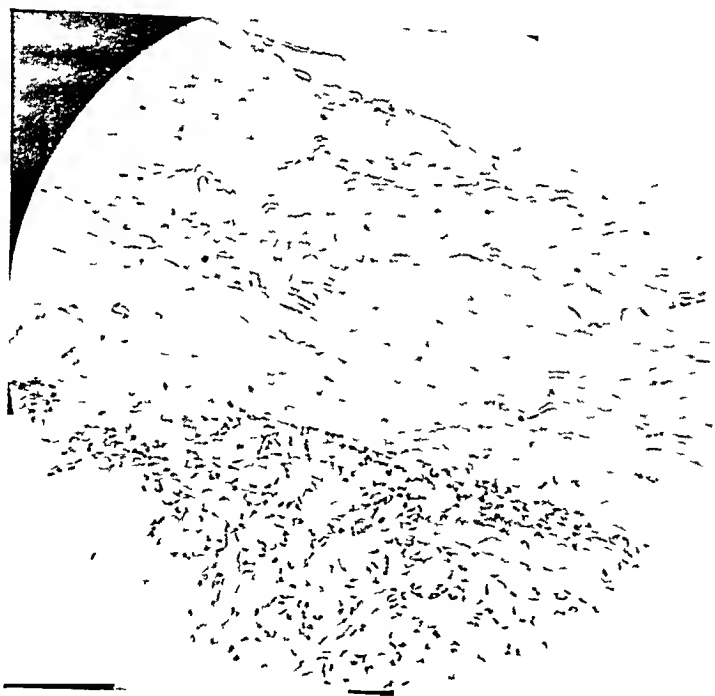
Post-operative course without event, similar to other pleasant

FIG 5



C cyst wall, A adjacent kidney tissue, S, small cyst lined by cubical epithelium

FIG 6



anything suggesting cystadenomatous changes There are no glomeruli present in any of the sections, the cyst being entirely confined to the pyramid (Figs 5 and 6)

There are several interesting reflections from the case to which attention is directed In the first place, the diagnosis of the kidney lesion was quite difficult The patient was thought to have a ureteral calculus from his history and from the first X-ray findings The passage of a No 7 ureteral catheter to the renal pelvis on each side, and the withdrawal of clear uncontaminated urine with no disturbance of renal function, seemed to eliminate the ureter as well as the kidney Then with the definite high-grade involvement of the prostate, seminal vesicles and deep urethra, and the marked amelioration of symptoms after treatment was directed to them, these organs were thought to be the only offenders Later examination with the ureter catheter and X-ray proved this not to be the case, as did the continuation of the renal pain after the other symptoms had subsided We were dealing with a double picture The urinary distress, hæmaturia, and the lower referred pains were undoubtedly referable to the prostate and deep urethra, and the upper pain to the kidney The case demonstrated how careful one must be in attributing a pain in the renal region to lesions of the prostate, vesicles, and urethra While the author has firm belief that such pains may originate from the genitals, still he feels that every possible means should be utilized to rule out the upper urinary tract before one makes his decision

Whether the acute colic in the advent of the disease was due to plugging to one of the straight tubules of the papilla with a small concretion or to the breaking off of some calcareous material previously deposited, the author is not prepared to say, but is inclined to think the latter

There are certain pathological features which seem worthy of special mention The limitation of the cyst to the pyramid with its demarcation from the cortex is out of the ordinary Why this happened, is uncertain There is no anatomical reason for it It may be that the cyst was in its infancy and

ture at his disposal. The lesion presented in the above case of a dense papillary sclerosis with incrustation of calcium phosphate confined to one papilla, is as far as he has been able to determine, unique.

*Pathogenesis*—The literature on the origin of kidney cysts is very voluminous and this paper will be presented in abstract. A full account appeared in the *Transactions of the American Association of Genito-Urinary Surgeons*, 1912. It will be sufficient to say that the main theories which have been proposed have been the retention theory, the new formation theory, the theory that colloid changes of the epithelial and connective tissue cells serve as an origin, the congenital theory and a theory proposed by Kiause, which is that the kidney cysts are sometimes secondary to atrophy of the renal lobule in early life, corresponding to an obliteration of one of the branches of the renal artery. Later the lobule undergoes inflammation, fatty degeneration and cyst formation.

Each of these theories has had a long list of adherents, particularly the two important theories, that is, the congenital and retention, and even at present there is no unanimity of opinion. At a meeting of the French Association of Urology in Paris, in 1911, a symposium held on kidney cysts evoked the same unsettled state of affairs concerning their origin.

The idea is prevalent that cysts even of medium size cannot originate through obstruction of inflammatory origin, either from within or without the tubules. This is undoubtedly erroneous, as in the author's case there was a definite inflammatory obstruction and a fair size cyst. Evidently some of the cysts in so-called otherwise normal kidneys which have been thought to be of congenital origin might have been due to obstruction of inflammatory nature, as in early cases a careful microscopic examination in the region of the cysts was not made and it is possible that the lesion might have been overlooked. Those who contend that all kidney cysts are of congenital origin are unquestionably making a statement which is unjustifiable. It seems evident from a review of the cases which have been reported that some of the cysts must be considered of congenital origin, while the majority

bisecting the kidney, placed a silk thread in the papilla with the hope of setting up a progressive inflammatory reaction around the foreign body. He was never able to produce a cyst. The final result was atrophy.

Tollens cauterized single papillæ in order to get a definite localized obstruction. He studied the kidneys four, eight and a half, and twelve weeks after the experiment. At the end of four weeks there was complete obstruction of the ducts of the papillæ with retention of secretion and moderate dilatation of the canals of the cortex and the medulla, lined with cuboidal and flattened epithelium. After eight and a half weeks there was still dilatation, most marked in the straight canals, but no definite cysts.

It would seem that there are possibly two extremes exemplified in these experiments. In the first, it is probable that the foreign body did not cause a sufficient reaction to stimulate a progressive obstruction, hence, the result. In the second, by cauterizing the papilla there was produced a sudden complete obstruction. Under such circumstances one would expect exactly the results which were obtained, that is, a temporary dilatation with subsequent atrophy, similar to the results, if the same process had occurred in the ureter or in the excretory duct of any gland. Had the obstruction been intermittent, incomplete, or progressive, it is easy to conceive that a dilatation and cyst formation would have been produced, just as hydronephrosis arises under like circumstances.

A very interesting series of experiments, bearing upon this subject and representing the selective action of chemicals upon the papillæ, were conducted by Levaditi, who was able by subcutaneous injection of vinylamin to produce a papillary necrosis and sclerosis similar to the lesion described in the author's case. In his experiments he used mice, rabbits, guinea-pigs and goats, and was able to regulate the dosage in order to produce either an acute or chronic poisoning. In chronic poisoning there occurred a papillary necrosis with incrustation and retrodilatation.



erally unilateral, situated either in the cortex (Morris) or the medulla (Follin, Duplay, Bouilly, Lanceriaux) Terrier believes that the difference is due to the stage of development in which they are seen. He, with Cornil and Ranvier, believes it difficult to specify any elective part. The usual location is at one or the other pole. Terrier reports cysts six times in seven cases at the upper pole. Simon's 52 collected cases gave 18 at the lower pole, 8 at the upper pole, 8 at different parts of the kidney, such as the anterior surfaces, posterior border, and convexity.

These cysts vary markedly in size, ranging from a small walnut to the size of a child's head or larger. The case reported by Morris showed a tumor occupying the greater part of the abdominal cavity and weighing 16 pounds. Englander's case presented a cyst the size of a child's head. Von Brackel obtained two and one-half litres of fluid from his case. Rendu reports a cyst containing ten litres of fluid. Le Dentu believes that the position of the cyst bears a great influence on its size. Those situated in the cortex are usually small, while those in the medulla are usually very large. Sometimes the cysts communicate directly with one of the renal calyces. The cyst contents are also quite variable, sometimes clear and transparent, at other times turbid, gelatinous, or caseous. The color ranges from water-color to deep yellow, occasionally bloody. The reaction in most cases is alkaline, at times acid. Specific gravity, 1010-1020. The chemical constituents which have been found are chlorides, phosphates, albumin, serum globulin, cholesterol, urea, and water. The presence of urea has created considerable discussion. Many authors, among whom may be mentioned Follin, Duplay, Bouilly, Desnos, say that one never finds any of the urinary constituents in the cysts. However, urea is frequently found, though generally in small amounts. Hemorrhages may occur in the cysts as the result of trauma or extravasation.

*Microscopic* — The cyst wall varies in thickness from that of tissue-paper to one of considerable thickness and firmness,

Englander, the tissue around the cyst is thickened, but presents no remarkable changes. The cyst wall has been described as continuing, without a clear line of demarcation, to the normal tissue. Most observers report the tubules near the cyst distorted, some compressed, others dilated, whose epithelium shows granular degeneration. The glomeruli present various changes from the normal to those seen in nephritis. The etiological foundation for the production of the cyst has been theoretical in most of the cases, the origin of the obstruction has not been determined.

*Treatment*—The treatment of so-called simple or serous cysts of the kidney has varied with the times. In the early days of renal surgery, puncture was a method of attack, either alone or followed by injections into the cavity. This procedure was uncertain and not without risk. It was generally necessary to make repeated puncture, owing to the re-filling of the cyst and the process was trying to the patient and unsatisfactory to the surgeon. Touren in 1865 reported a case treated by puncture followed by caustic injections. Iodine has frequently been used as an injection into the cavity after the removal of the contents. With the method of puncture and injection, one runs the risk of having multilocular cysts as a result. Lejar's statistics of 7 patients treated by puncture gave 3 cures and 4 deaths. Three patients treated by puncture and injection, 3 deaths. In the light of renal surgery of to-day, such methods should only be employed in cases of very voluminous cysts to diminish their size so that the removal will be more easily executed.

Cystotomy was also an operation performed quite frequently in the days of yore. It was done either through the lumbar or transperitoneal routes. By the lumbar operation the cyst is exposed, opened, and emptied of its contents. The redundant wall is cut away, the edges then are fastened to the deep layer of lumbar fascia. The secreting surface of the cyst is destroyed by carbolic or nitric acid, and the cavity allowed to contract and granulate. The transperitoneal method is on the same principle, the cyst is opened, contents

many cysts scattered in one kidney Quenu in 1882 reported 7 nephrectomies, 5 cures and 2 deaths Lejars in 1889, 16 nephrectomies, 9 cures, 7 deaths Albarran, 7 nephrectomies, no deaths Tuffier collected 24 nephrectomies for cysts, 13 cures and 11 deaths A glance at the above illustrates a very high percentage of mortality following the operation The statistics of Albarran are more in accordance with the reports of individual operators of recent date The improvement is undoubtedly due to more refined technic and to a more thorough knowledge of the functional ability of the remaining kidney

In conclusion, the author desires to delineate and emphasize a few features in his case which seem to be of particular interest in comparison with other cases of a somewhat similar nature that have been previously reported

As has been the rule in most cases, the diagnosis of the kidney cyst was not made before operation The diagnosis in this case was renal calculus In examining the X-ray plates since our acquaintance with the condition, it is very easy to see upon which shadow, crescentic in outline, in the region of the renal pelvis, the diagnosis of stone was made External to this there is a very faint shadow about the size of a half dollar, which was thought to be an artefact, but which is evidently the cyst wall It is so faint that reproduction is impossible The urinary findings at the first examination are easily explained by the fact that no urine was being obtained from the affected area, the papilla being completely obstructed There was evidently a compensatory hypertrophy of the remaining renal parenchyma, explaining the normal renal function

The pathological aspect of the case is very interesting in that the primary lesion, if not unique, is extremely rare, it being a dense papillary sclerosis with incrustation of calcium phosphate confined to one papilla, the other papillæ being, as far as could be determined in a normal state of preservation The condition was responsible for the retrodilatation and cyst formation, a process which many authors consider impossible The other interesting points are that the cyst was entirely con-

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# AN EXPERIMENTAL STUDY OF SEVERAL METHODS OF SUTURING THE KIDNEY.

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THE damage done to the kidney by operation was discussed in a former communication to the ANNALS OF SURGERY (vol lIII, p 373), by the authors of this paper. The damage done by incision, and the damage done by subsequent suture, comprise two distinct types of trauma. In the first class are such lesions as result from the anæmia produced by the cutting of the blood-vessels by the knife. These lesions usually consist of small anæmic infarcts, the shape and size of the infarct depending upon the distribution of the severed vessels. The damage done by the suture is usually much more extensive and very much more erratic. This may range anywhere from the late destruction of the entire kidney to conditions in which there is only a very little new scar tissue. One of the unfortunate results from applying ligatures is the strangulation of small pieces of the kidney parenchyma, particularly in the pyramids. Such strangulated material may become calcified, and later on form a basis for a calcium phosphate stone (Fig 1). This particular specimen was taken from an animal experiment in which the apex of a papilla was purposely strangulated by a circular suture. On killing the animal three months later, the condition found in the picture was shown. Beside the single large stone, there were found a great many smaller stones in the pelvis of a hydronephrotic kidney.

The infarcts resulting from a strangulation of tissue grad-

to the silver wire method of opening the kidney are as follows (1) difficulty in locating the bloodless zone of the kidney, (2) danger from hemorrhage in that some aberrant vessels often cross the kidney in a very irregular manner, (3) that the method necessitates the cutting of a number of collecting tubules and other kidney structures, (4) that the wire traumatizes and is difficult to control

We have done a considerable number of operations with the knife, both disregarding entirely the bloodless zone and observing the bloodless zone, and an equal number with the wire in the bloodless zone. After these operations the animals were killed, and the amount of damage done to the kidney by these various procedures compared. In establishing the extent of damage done to the kidney, the entire structure was cut into sections approximately 1 cm in thickness. These sections were photographed, and accurate measurements of the surface area of each infarct were made. When all of these surfaces had been measured, an average was taken. These figures were divided by a divisor obtained by dividing the size of the kidney under consideration, by a figure taken as a standard size for the kidney. Frequently as much variation occurred in the size of the infarcts with one method as with another. With the wire method sometimes the infarcts were very irregular (Figs 2, 3, and 4). In one instance where the animal was kept for 90 days after operation, nearly one-fifth of the kidney had suffered destruction (Fig 5).

The tubules do not run parallel to the bloodless zone, therefore, in following this direction of incision, tubules are cut across. This is further accentuated with the wire, for the reason that it is not under perfect control and may traumatize tissues for a considerable distance. While in the process of healing, patent tubules may result by a growth of epithelium over the scar tissue, it is more frequently found that in animals where the silver wire method had been used, there occurred an atresia of the tubules due to compression of scar tissue, with the consequent result that may be expected

FIG 3



Kidney split with silver wire in bloodless zone (Five days)

FIG 4



Kidney split with silver wire in bloodless zone (Five days)

A TABLE SHOWING RESULTS FROM VARIOUS METHODS OF SUTURE —THIS TABLE IS INTRODUCED TO SHOW THE AMOUNT OF DAMAGE THAT MAY RESULT FROM SUTURE METHOD II REFERS TO MATTRESS SUTURES METHOD III REFERS TO THROUGH-AND-THROUGH SUTURES WIRE METHOD REFERS TO SILVER WIRE METHOD METHOD IV REFERS TO SERREFINE CLAMP METHOD WITH FINE THROUGH-AND-THROUGH SUTURE

A E No	Time after operation	Method	Result
II-19	17 days	II	Death Uræmia, acute degeneration
II-18	3 months	II	Almost complete cicatricial destruction of kidney
II-34	4½ months	II	Calculi Death from uræmia Nitrogen excretion abnormal
II-1	3 months	II	Stones obstructing ureter
II-17	6 months	III	Kidneys weighed 64 and 61 Gm Nitrogen excretion normal Some cicatricial loss of parenchyma (Fig 7)
II-74	30 days	Wire	Variable infarct (See Fig 2)
II-80	5 days	Wire	Variable infarct (See Fig 4)
II-25	3 months	Wire	Loss of one-fifth of kidney One-tenth of parenchyma damaged
II-113	1 day	IV	Thin infarct
II-128	7 days	IV	Thin infarct
II-76	10 days	IV	Mere line (Fig 6)
II-129	3 months	IV	Weight same Slight loss of parenchyma, due to excessive tension

To the objections that the temporary cutting off of the blood supply of the kidney might result in some damage to the kidney, a series of experiments were undertaken to show what changes occurred in a kidney as a result of a series of atresias of the vessels for various periods of time In this series of experiments, the kidney was loosened from the peritoneal covering, a soft-jawed serrefine clamp applied to the vessels, which was allowed to remain there for either one or two hours, as the case might be In the one-hour series, the animals were killed at various periods of time subsequent to the procedure, and the kidneys were studied by making sections and staining them by the following methods (1) Zenker and hæmatoxylin, (2) Bell's acid chromic mixture, and Soudan III, (3) formalin and hæmatoxylin

As a result of this work, the only lesions recognized were as follows



A TABLE SHOWING THE DAILY AMOUNT OF URINE, THE NITROGEN OUTPUT, THE NITROGEN INTAKE, AND THE WEIGHT OF AN ANIMAL IN WHICH THE RIGHT KIDNEY HAD BEEN REMOVED AND THE LEFT KIDNEY HAD BEEN SUBJECTED TO DAMAGE BY CLAMPING THE RENAL VESSELS FOR ONE HOUR (A E 12-63)

No	Date 1912	N per c c	Quantity	Total N	N I	Carrots Grammes	Weight Grammes.
9	5-24	0 003064	335	1 026		390	2250
11	5-25	00220	190	418		125	
15	5-26	00276	270	745		133	Albumin+

## AVERAGE

First three days after operation 0 729

16	5-29	0 005025	340	1 708		350	
17	5-30	003037	350	1 062		500	

## AVERAGE

Four and five days after operation 1 370 Albumin+

18	8-13	001905	360	0 685	1 020	500	2610
20	8-14	001684	365	624	1 020	500	
22	8-15	002291	355	813	979	480	
24	8-16	001910	577	1 102	1 020	500	
26	8-17	002428	225	545	969	475	
28	8-18	002153	365	784	858	420	
29	8-19	002319	365	846	898	440	
31	8-20	002540	355	902	776	380	
32	8-21	001794	335	601	707	3472	2538
35	8-22	003589	213	764	846	415	

## AVERAGE

Three months after operation 0 711

A TABLE SHOWING THE DAILY AMOUNT OF URINE, THE NITROGEN OUTPUT, THE NITROGEN INTAKE AND THE WEIGHT OF AN ANIMAL IN WHICH THE RIGHT KIDNEY HAD BEEN REMOVED AND THE LEFT KIDNEY HAD BEEN SUBJECTED TO DAMAGE BY CLAMPING THE RENAL VESSELS FOR TWO HOURS (A E 12-69)

No	Date 1912	N per c c	Quantity	Total N	N I	Carrots Grammes	Weight Grammes
19	8-14	0 002761	360	0 9939	0 918	450	1995
21	8-15	002108	345	7272	918	450	
23	8-16	00220	300	6600	918	450	
25	8-17	002484	225	5589	867	425	
27	8-18	002484	185	4595	795	390	
30	8-19	001910	235	4488	816	400	
32	8-20	001794	295	529	795	390	
34	8-21	001910	330	630	836	410	
36	8-22	002346	265	621	826	405	
37	8-23	00220	325	715	903	345	1995

## AVERAGE

Three months after operation 0 63433 8392

# "DUMB-BELL" KIDNEY.<sup>1</sup>

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AN unusual difficulty which might be met in renal surgery on the living patient is illustrated by a recent experience in attempting nephrectomy on a cadaver in the Laboratory of Anatomy of the University of Pennsylvania. The body was that of a male aged seventy-one years, whose length of life and whose clinical history would preclude any suggestion of inadequacy of renal function. The specimen was found while attempting to remove the kidney through a lumbar incision, which we were unable to do. After complete exposure of the kidney through the left loin, the cause of the impossibility of delivery was found to be due to a congenital abnormality, the main feature of which was a continuity of the renal tissue of one side with that of the other across the spinal column. This could be determined readily by means of a finger passed along the dorsal surface of the renal tissue. In freeing the kidney a large renal artery from the left common iliac to the left lower pole was torn away in the supposition that we were dealing with a perirenal adhesion, an unlikely mistake in the living, in the presence of pulsation.

The specimen consists of two lateral masses of kidney substance with a connecting bar of the same tissue. These masses are flattened from before backward and with the intervening tissue suggest, on anterior view, the form of a dumb-bell (Fig 1).

*Right Half*—This portion is, like its fellow, irregularly rounded in outline but of somewhat greater transverse diameter. The posterior surface is made up entirely of smooth renal tissue, while the anterior surface is hollowed out in its central portion to form what is really the

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\* Read before the Philadelphia Academy of Surgery, February 3, 1913



outward a renal artery from the common iliac. The uretero-pelvic junction is at the lower margin of the kidney substance, and the pelves soon divide into calices, six on the right and four on the left side, one on each side apparently draining the isthmus. The greatest width of the right pelvis is two inches and that of the left, one and one-half inches. The pelves and ureters are placed anterior to the kidney tissue and for the most part below the renal vessels.

*Blood Vessels*—There will be noted a deflection of the aorta and the vena cava to the right and an apparent difference in length and topography of the iliac vessels, these are artefacts due to the injection of the cadaver. In consequence the right common iliac artery has a more vertical and apparently a shorter course than its fellow.

The branches of the aorta present many anomalies. They arise, from above downward, in order as follows: (1) Inferior phrenic artery, (2) celiac axis, (3) superior mesenteric, (4) right renal, one-half inch below the preceding, (5) left renal, (6) left spermatic, probably a renal giving a spermatic branch, (7) inferior mesenteric, (8) first lumbar, (9) second lumbar, (10) renal, from the anterior surface of the aorta, one and one-half inches from the bifurcation and just above another renal, (11) renal, just below the preceding, (12) third lumbar, (13) median sacral.

There will be noted as being absent from this list the suprarenal, right spermatic and fourth lumbar arteries. The suprarenals come from the renals, the right spermatic from a renal branch given off from the right common iliac, and the fourth lumbar from the common iliacs. With the exception of the right spermatic nature has compensated for the absence of the suprarenals and fourth lumbar by the addition of two anomalous renals, thus establishing the normal quota of branches derived from the abdominal aorta.

*Renal Arteries*—Seven arteries are given to this dumb-bell kidney. Four of these come from the aorta, one from each common iliac artery, and one from the left spermatic. This latter is probably as explained above, a renal artery giving origin to the spermatic.

Considering the renal arteries from above downward, the first one arises from the right antero-lateral surface of the aorta, one-half inch below the point of origin of the superior mesenteric, passes behind the vena cava, and gives off the right suprarenal and a slender branch to the upper pole of the right kidney. Then, crossing the upper portion of the renal tissue to reach the hilum, it sweeps around the outer edge of the latter, half encircling it, and finally turns directly transversely to enter the substance of the kidney at its centre. It gives eight branches to the kidney.

The second renal arises from the aorta one inch below the preceding vessel and at a corresponding point, and has a similar course. In addition to the four branches which it gives directly to the kidney, a large branch arises one inch from its origin. This soon divides into a mesial and a lateral branch. The mesial branch gives off two slender twigs which course along the upper margin of the isthmus to enter the right hilum, a third to the left end of the isthmus and a large terminal to the mesial

life has reached its adult position. Fusion of the renal masses, as in this case, would cause retardation in the ascent, probably as a result of the development of the sacral promontory, which would offer obstruction to the isthmus in the mid-line and prevent the normal passage upward of the lateral masses along the ilio-lumbar grooves. Nature vascularizes the renal tissue from adjacent vessels and this would contribute to the difficulty of ascent, as illustrated by the markedly angular course of those renal arteries in our specimen which are derived from the anterior surface of the aorta near its bifurcation. It is our conception that the dumb-bell type illustrates fusion of the lower poles of the primitive kidneys which in ascending were rotated as it were on their backs and transversely, as a direct result of retardation in ascent of the mid-portion or isthmus.

*Review of Literature*—The horseshoe kidney, a rare variety of which we present and describe as a "dumb-bell" kidney, is the most common type of a single mass of misplaced kidney tissue of abnormal form. The bases of Morris' convenient classification are abnormalities in number, position and form, and our specimen deviates from the normal in all three of these essentials. We will confine our remarks to a consideration of numerical congenital anomalies, at the same time calling attention to the almost constant association therewith of morphologic and topographic defects.

The numerical congenital abnormalities may be divided into three groups: (A) Absence of both kidneys, (B) supernumerary kidneys, (C) single kidney.

(A) The absence of both kidneys is not merely a "teratological curiosity of the first months of embryonic life" as held by Guiteras,<sup>1</sup> for the vital functions can go on in both intrauterine and extrauterine life in the complete absence of renal tissue.

Ballowitz<sup>2</sup> and Mayer<sup>3</sup> report the congenital absence of the kidneys in a large number of living and still-born children. The extraordinary case of Moulon<sup>4</sup> of a girl, who reached the age of fourteen and in whom post-mortem examination proved the entire absence of renal tissue, would indicate the

Anders<sup>12</sup> collected 286 cases from the literature up to March 1912. This author, from a review of 92,690 autopsies, estimates the frequency of this defect as one in 1817 cases, and quotes the estimate of Dennis<sup>13</sup> of one in 2650 cases.

In our own studies we have found three instances of the condition in a series of 2479 autopsy reports kindly placed at our disposal by Dr. Allen J. Smith. The complete list of the congenital defects of the kidneys found in this series is given in the following statistics (total cases, 2479):

*a* Unsymmetrical kidney—3 cases

Infant three days old. Left kidney unusually large and malformed, right kidney absent, patulous foramen ovale and ductus arteriosus.

Young girl. Right kidney and ureter absent, left kidney twice the normal size, congenital recto-vaginal fistula.

Male, aged sixty-three. Right kidney, ureter and vessels absent.

Congenital misplacement	.. .	3
Movable kidney	. . .	11
Type not stated	.	8

*b* Abnormalities in shape

Horse-shoe	.. ..	3
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Male, aged fifty. Pelvis arising from posterior surface of right kidney, both kidneys nodular.

Male, aged eighty-four. Slight irregularity in shape.

Male, aged sixty-three. Right kidney low in position and hilum pointing anteriorly.

Persistent fetal lobulation	.	10
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Morris<sup>14</sup> estimates the frequency of unsymmetrical kidney from the records of 15,904 autopsies and the collected statistics of several authors as one in 2400 cases. Ransohoff<sup>15</sup> collected the statistics of eleven operations on unsymmetrical kidneys, four nephrotomies and seven nephrectomies. A list of 226 cases is given by Craven Moore<sup>16</sup> from collected autopsy statistics.

Laparotomy for pelvic tumor in a female aged seventeen

various grotesque forms described by Bloesike,<sup>20</sup> Vaughn,<sup>21</sup> Botez,<sup>22</sup> and others.

The horse-shoe kidney occurs once in a thousand cases, as Morris estimated from 18,244 autopsy records from four London hospitals J. E. Thompson<sup>23</sup> quotes Both who found five examples of the anomaly in 1630 autopsies We found three such kidneys recorded in 2479 autopsies

*Associated Congenital Anomalies*—Congenital defects of other structures and organs are frequently found in association with solitary and unsymmetrical kidneys, especially the latter The organs derived from the Wolffian and Mullerian systems are likely to be malformed or absent, usually on the side of the renal defect Associated congenital defects of the external genitalia or of the cloacal orifice are frequently found Persistence of the ductus Botalli, foramen ovale and ductus arteriosus have been reported Craven Moore estimates the frequency of association of unsymmetrical kidney with defective development of the genital system as thirty-three per cent Of 61 cases of unsymmetrical kidney collected by Anders, 21 had other congenital defects, in the majority of cases involving the genital organs Since the ureter is developed as an out-growth from the Wolffian duct, faulty development of the latter may be primary and thereby explain the association of urinary and genital defects In the female, however, the urinary defect is no doubt primary, since the Mullerian ducts are not fully formed until the kidney is well developed and has ascended into the loin space, but having a common mesoblastic origin defects in the renal system would likely be associated with defects in structures derived from the genital cord The practical importance of this association can be most forcibly expressed by reference to Moore's case cited above

*Clinical Importance*—The malformed kidney as a rule gives rise to no clinical symptoms unless complicated or through pressure as the result of misplacement Any disease to which the normal kidney is subject may affect the malformed organ, but hydronephrosis and its frequent sequel,

kidney diagnosis furnish pre-operative evidence of the futility of operative treatment in these fortunately rare cases

Important steps in the recent progress of the surgery of the horse-shoe kidney are the division of anomalous blood vessels causing ureteric obstruction, division of the isthmus to relieve pressure symptoms, uretero-pelvic anastomosis, plastic operations on the renal pelvis for hydronephrosis and heminephrectomy by the transperitoneal route

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The origin of true traumatic hydronephrosis may be a variable one. In the first place, traumatic injuries to the ureter which complicate the renal injury are of the utmost importance. They are invariably situated high up, near the origin of the ureter. The walls of the ureter may be contused, and lacerated, or they may be ruptured, or even completely severed. In any event, the outcome is a cicatricial stenosis or occlusion at the point of injury. Wagner believes that a perirenal bloody extravasate, due to the renal injury and to the traumatism of the surrounding tissues, may lead to compression and total occlusion of the uréter, while the ureter itself remains uninjured. Likewise some of the blood may clot and become organized, this, in turn, causing torsion and stricture of the ureteral wall.

Another cause of true traumatic hydronephrosis commonly accepted as correct, is that of a blood clot in the ureter, following an injury to the kidney. Kuster, while not denying that a clot in the ureter may lead to a temporary dilatation of the renal pelvis, with retention of urine and blood, is still unwilling to believe that this can be permanent in the case of an uninjured ureter. The increasing pressure above would necessarily distend the ureter so that the arrested urine would find its way alongside the clot. Thus the frequent repetition of this process would sooner or later result in detachment and washing away of the clot. That this is true, has been proven by numerous clinical experiences, and contrary observations are very scanty, and in no case beyond criticism. The truth of this assertion is borne out by the case of Kroner, where a blood clot was found in the ureter at operation (nephrotomy) and the ureter soon regained its patency. Also in Wagner's case, it is probable that the temporary obstruction was due to a clot in the ureter, for there was initial hæmaturia, and the ureter subsequently became patent, following nephrotomy. If, however, the ureteral wall be injured at the site of the clot within the ureter, it is believable that organization may well take place.

Aside from the foregoing primary causes of true traumatic

The differential diagnosis must take into consideration those other conditions in which a renal tumor is found, and which are observed as direct sequelæ of injuries to the kidney. Among these may be mentioned (a) hæmatonephrosis, (b) pyonephrosis, (c) pseudotraumatic hydronephrosis, (d) ruptured hydronephrosis.

An absolutely correct diagnosis of true traumatic hydronephrosis can only be made by observing the kidney and sac at operation or autopsy. The characteristic features here are the expanded pelvis, the swelling being a true tumor of the pelvis of the kidney, the dilated calices, the flattened papillæ of kidney tissue, and, lastly, a demonstrable obstruction in the ureter. However, it is to-day possible that by injecting the ureters with silver salts and the use of the X-ray, a kink, twist or obstruction of the ureter may be located and the diagnosis made more probable thereby.

In tabulating the cases found in the literature, different authors have been somewhat at variance with each other—some admitting one case because of its great probability, others rejecting it for lack of indisputable evidence. Any such tabulations must, of necessity, be incomplete owing to the fragmentary reports of some of the cases. In the tabulations given below, only cases of undoubtedly true traumatic hydronephrosis have been admitted, and in every instance the case has been subjected to operation or observed at autopsy.

*Case Report*—A J, male, twenty-two, well built, admitted to St Vincent's Hospital on August 8, 1910, with the following history. His family and past history negative. Occupation, assistant at a cotton press.

About four months previous (in April), while holding to the end of a long lever by his right arm, he was jerked unexpectedly upward about four feet into the air. Severe pain was immediately experienced in the right loin and kidney region. He was unable to resume work until three days later. He was hæmaturia at the time of the accident. There was no tenderness in the lumbar region, he noticed nothing abnormal in any way until three weeks after the accident. At this time he had

a suppression of urine lasting 24 hours, and then passed an unusually large quantity within a few minutes

He was well for two months, when late in June a total suppression came on again, lasting three days this time, after which even a larger quantity of urine than previously was voided

And again he was well and working, until the last day of July, when a complete suppression of urine set in and lasted up to the time of admission to the hospital on August 8, a total suppression of eight days

*Physical Examination*—The physical examination revealed a large, tensely fluctuating tumor, the size of a child's head, in the right lower quadrant of the abdomen. An impulse in the right costovertebral angle was easily transmitted through the swelling to the anterior side of the abdomen

The tumor was obviously a collection of urine. A catheter introduced into the bladder found that viscus dry. The patient's condition was such that catheterization of the ureters and X-ray pictures were out of the question. An important question which presented itself was, Why did the left kidney not functionate?

Immediate operation was decided upon, with the intention of exploring the left kidney first

*Operation*—The usual posterior lumbar incision was employed on the left side, but despite a most thorough and careful search, remembering the possibility of the kidney's being placed on the sacrum, or again at the external abdominal ring, as sometimes occurs in the case of rudimentary kidneys, no kidney could be found. The incision was closed

A similar incision was made on the right side over the tumor. A distinct, thin sac, through which dark fluid could be seen, was at once exposed. Three quarts of dark, foul smelling urine were evacuated. Here and there, between the dilated calices, were to be seen small, flattened masses of kidney tissue. The largest pieces to be found were about the size of a thumb. The whole kidney was an expanded sac. The kidney itself was well down in the pelvis, and about one and one-half inches below the kidney the ureter was kinked at a very acute angle. Attempts to pass an ureteral catheter beyond this angulation were without result. This was undertaken to ascertain the patency of the ureter, and also with the idea of leaving the catheter in place a

drain the bottom of the hydronephrotic sac was refused. Under daily irrigations of the sac with weak silver nitrate solutions the fistula closed after two weeks.

Reports from the patient every month thereafter indicated that he was working and enjoying good health in every respect. Exactly one year after the closure of the fistula, which had remained so, he was brought back to the hospital suffering from symptoms of uræmia. The region of the old lumbar scar on the right side was red and fluctuating. A small incision made under local anæsthesia allowed twenty ounces of foul purulent urine to escape. The patient went into collapse, and died a few hours later. By a singularly unfortunate chain of circumstances the autopsy which had been promised was lost.

I am much indebted to Dr Cunningham Wilson for the privilege of reporting and operating upon this case, which occurred in his service, and to Drs J M Mason and Walter Scott for the cystoscopic work.

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After determining the approximate capacity of each renal pelvis, a 15 per cent collargol suspension was injected with a piston syringe, the right pelvis holding 20 c.c., and the left 16 c.c. There was considerable pain following this trial, but the skiagrams were not satisfactory. Because of this failure the pyelographic work was repeated after the lapse of some five weeks, and a 25 per cent suspension was used. At this time 12 c.c. were injected into the right ureter and 10 into the left, when pain became excruciating especially on the right side.

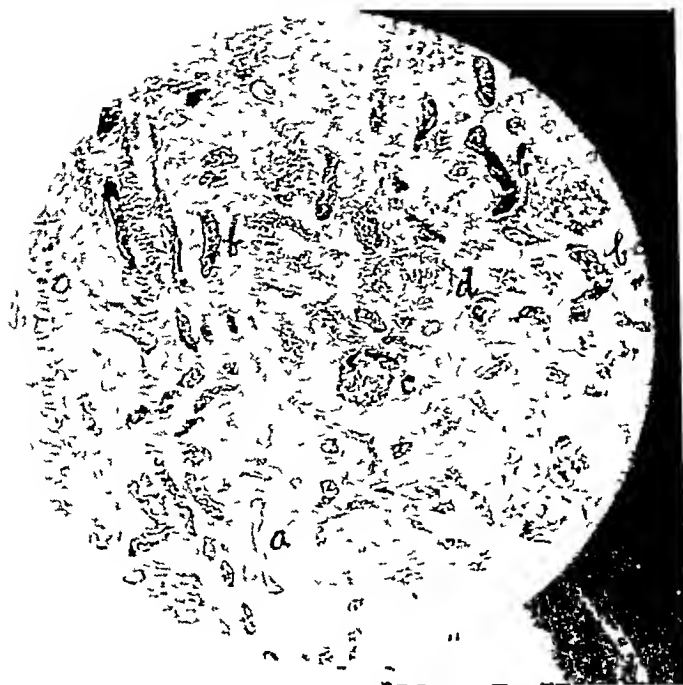
The skiagrams at this time gave quite clear views of both pelvises, that of the right being large and irregular as compared with the normal left (Fig 1). There was also observed a marked shadow well out in the parenchyma extending from the centre of the right kidney, infiltrating into its upper pole. Many theories were advanced for this shadow, and it was finally assumed that there was a diseased area connected with the renal pelvis which the pressure of the fluid had opened and the collargol penetrated. A slight rise in temperature which continued for three days followed this catheterization.

An exploratory incision being advised and accepted, some two weeks after the last ureteral catheterization, the right kidney was exposed and it was found to be ptosed and enveloped in a great amount of inflammatory adhesions. When the kidney was finally released from this bed of adhesions, a large wedge-shaped area of kidney substance about two inches wide was found to be infiltrated with the collargol and the capsule covering this infarct was lifted from the parenchyma by a layer of collargol. This mass or infarct was found to extend down to the renal pelvis, and was resected without going into the pelvis. The kidney was then turned over so that the pelvis was at the low point, and anchored at a higher plane. The patient had an uneventful recovery with relief of symptoms. The mass was then submitted to Dr. Ross C. Whitman, Professor of Pathology in the University of Colorado, whose report and illustrations follow.

**PATHOLOGICAL REPORT**—The gross specimen measures 5 x 7 x 4 cm., consistency about normal. An area under the capsule, 3 cm. in diameter, is raised and black. The capsule peels readily, leaving a smooth surface. On section the black discoloration is seen to extend in the form of a broad wedge or fan towards and deep into the tip of the pyramids. The discoloration is distributed in columns corresponding to the tubules (Fig 2 enlarged about four times).

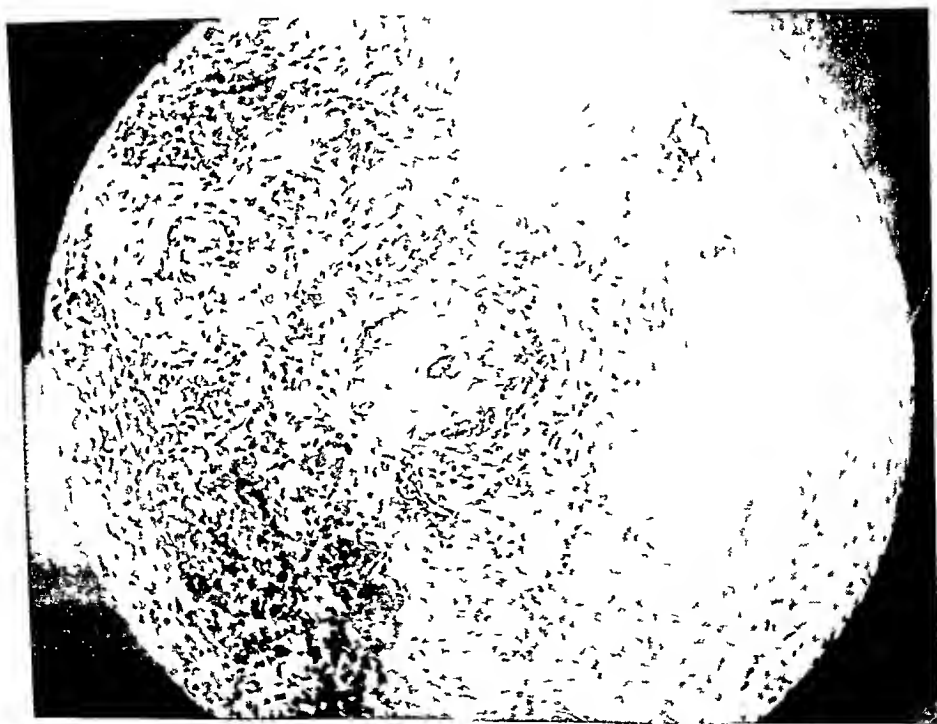
**Histological Examination**—The tissue was fixed in formalin, and

FIG. 3



Tubules and glomeruli containing collagen pigment (*a* and *d*) in small quantity or as a thin layer closely applied to the cells. Tubules filled solidly with a dense mass of collagen and small admixture of cells and detritus (*b* and *c*).

FIG. 4



*a* glomerulus containing a relatively small quantity of collagen pigment with a thin layer closely applied to the peripheral cells; also an intracellular infiltration of collagen

FIG 7



s kidney. Arrows pointing to the areas invaded by the collargol. This substance can be seen in the proximal convoluted tubules and under the capsule.

might have had such an outcome without surgical aid. But it is equally probable that a similar accident has frequently occurred in the past, but has passed unrecognized. It is hardly arguable that a diagnostic method which involves such a possibility is altogether safe or permissible.

After learning the real nature of this shadow a series of experiments were undertaken on the fresh pig kidney, twelve being used in the experiments. The kidneys were taken from the freshly killed hog and the tests applied within one hour after their removal from the animal. A device had been so fitted that it connected with a manometer and a graduate reservoir containing the collargol suspension, so that the amount of fluid used could be determined at the same time that the intrapelvic hydrostatic pressure was measured. A catheter was inserted into the ureter of the freed kidney and tied in place so that there might be no return flow, securing uniform conditions comparable with those which occur when the catheter completely fills the lumen of the human ureter.

The first kidney tested was of course given a greater quantity and pressure than was necessary, but the results were so like those found in the patient's kidney that further study was made. The infiltration of the parenchyma and free diffusion of the collargol under the capsule was almost simultaneous with the distention of the pelvis and the recording device indicated the use of 18 c c of collargol at a pressure of 240 mm, a compressed air device being used in this test.

Kidney number two was then tried and a distinct wedge-shaped infiltration occurred which extended out under the capsule in about one minute with the use of ten c c of fluid at a pressure of 80 mm of mercury. Kidney number three had an injection of 14 c c of fluid at 50 mm for five minutes, this test giving practically the same results as the earlier experiments, and this kidney was then placed on photographic plates and X-ray negatives made of it with the resulting shadows as here shown (Fig 6).

Following this the balance of the kidneys were treated in a like manner but using a small glass syringe in place of the compressed air. The same results were again secured with 16 c c of collargol delivered at a pressure of 40 to 80 mm. A test was then made to determine the average pressure when



# PRIMARY TUBERCULOSIS OF THE GLANS PENIS.

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PRIOR to the advent of present-day methods of asepsis and antisepsis, it was not all uncommon to see cases of primary tuberculosis of the penis follow non-ritual circumcision Perlis<sup>1</sup> and others have reported cases in which tuberculous infection following the simple operation produced complete destruction of the organ

The disease usually attacks the foreskin or prepuce It may appear first in the body of the penis, although it very rarely attacks the glans primarily The disease usually manifests itself in the form of a small ulcer which becomes progressively larger The disease is usually secondary to infection elsewhere in the body

The following case seems of special interest owing to the advanced age of the patient, the primary site and cicatricial character of the growth, the absence of evidence of tuberculosis elsewhere in the body, and the mode of onset of the disease

REPORT OF CASE—Patient, M B, white male, age 72, retired soldier, was referred to my service at the Deaconess Hospital by Dr Vinyard, of Jackson, Mo, with the history that about six months before he had noticed a small, hard nodule in the glans penis about midway between the corona and meatus The growth was painless and did not interfere with micturition, but became gradually larger until at present it is larger than a filbert The man was well nourished and in apparent good health The dorsal surface of the glans is bulging A very firm, smooth, oval-shaped mass occupies the greater portion of the glans The urethra is not involved and the patient urinates without trouble

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<sup>1</sup> Perlis Czasapismo lek, Lodz, 1899, 1, 313



# ON THE FORMATION OF BONE IN THE HUMAN PENIS

BY ARPAD G. GERSTER, M D,

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AND

F S MANDLEBAUM, M D,

OF NEW YORK

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THE fact that the formation of bone in the human penis is one of the rarest of phenomena may serve as an excuse for presenting a paper based on the observation of a single case

CASE REPORT—John B, male, Frenchman, restaurant keeper, 49 years old, married There was a history of syphilis, no gonorrhœa, no acute infectious disease Patient had worn a pair of corsets of the straight front type for three years About eight months ago he noticed at the place where, in the sitting posture, the lower anterior rim of the corsets impinged on the upper aspect of the root of the penis, the appearance of a small indurated mass the size of a pea Gradually this mass extended downward along the middle of the dorsum of the organ, until it reached its present size The presence of this body caused the patient no inconvenience whatever, except in erection of the penis, when an increasing amount of upward incurvation acted as an insurmountable obstacle to the introduction of the organ into the female genital tract On October 3, 1910, the following was noted

*Status Præsens*—Florid, somewhat obese man Pulse 80, temperature normal Arteries somewhat hard Lungs and heart normal Abdomen obese and pendulous Liver palpable, not painful, spleen non-palpable Genitals well developed Close to where the penis emerges from underneath the symphysis pubis, an oblong, lamella shaped, very hard body can be felt resting upon the dorsum, extending forward to the extent of 3.5 cm It's width is 1.75 cm It occupies the middle space

tissue are seen at a glance. On the other side of the bone a narrow zone of the same type of dense fibrous tissue is seen. Beyond this is a layer of muscle fibres, loose connective tissue, and small blood-vessels. The dense fibrous tissue just described represents the tunica albuginea, and the bone formation has taken place in this tissue.

The bone shows characteristic Haversian canals of various sizes, surrounded by more or less prominent concentric lamellæ and lacunæ. Some of the canals are of minute size and apparently empty, larger ones show the presence of cells having all the appearances of marrow cells. Running through the middle of the bone are several large oval shaped canals. Many of these contain true marrow and large multinuclear cells (osteoclasts?) and probably represent an attempt at the formation of a true central canal.

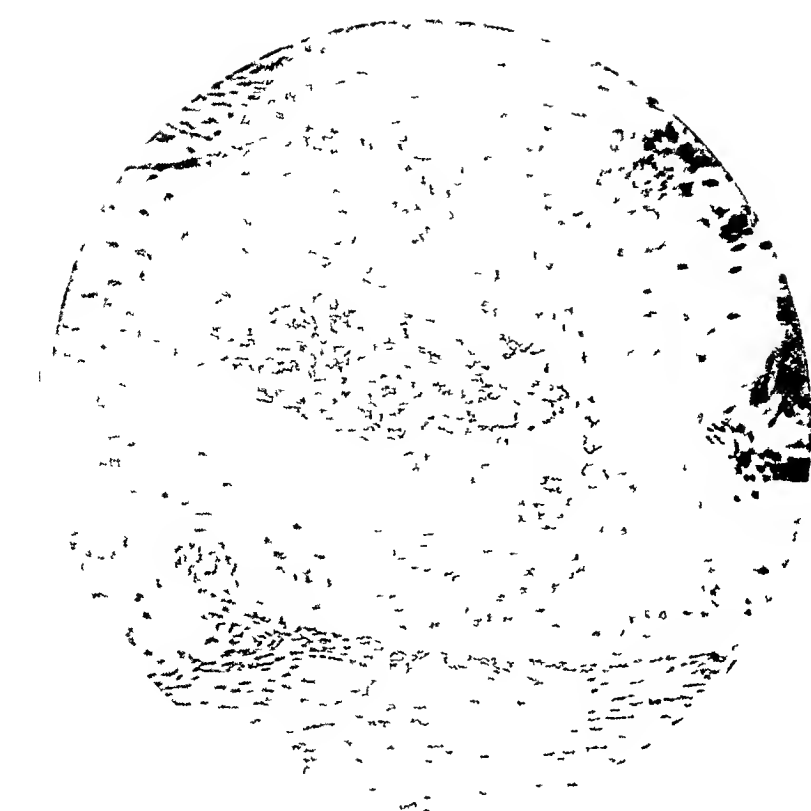
At the junction of the bone with the fibrous tissue on both sides, typical osteoblasts are seen in many places. In these situations narrow layers of faintly staining tissue of an osteoid character are noted. Here and there are deposits of calcareous matter with the characteristic staining reactions. These areas are occasionally very dense and homogeneous, some of them, however, show distinct lime particles. Osteoclasts are present in these situations in small numbers. Surrounding many of the areas of lime deposits are zones of young vascular connective tissue and osteoid tissue. In some places small blood-vessels are seen running from the fibrous tissue into the bone. These are not unlike the periosteal buds seen in the normal formation of bone from cartilage, but in none of the sections is there the slightest evidence of the presence of cartilage cells.

In searching the literature of this subject, it was found that the condition presented in this paper is of the utmost rarity. Paul Frangenheim, in describing the facts bearing upon a case observed in Lexer's clinic at Königsberg, has written a very instructive paper containing most of the observations on this subject up to 1907.<sup>1</sup> From this paper the following particulars of interest may be mentioned. Sachs<sup>2</sup> had collected the records of 187 cases of the so-called *plastic induration* of the penis. But up to 1907 specimens for actual examination were secured only eleven times, in five cases by operative removal of the indurated parts, and in six cases by autopsy. Among the latter the only American case was that of Chetwood. Since then are to be added four cases by Zur

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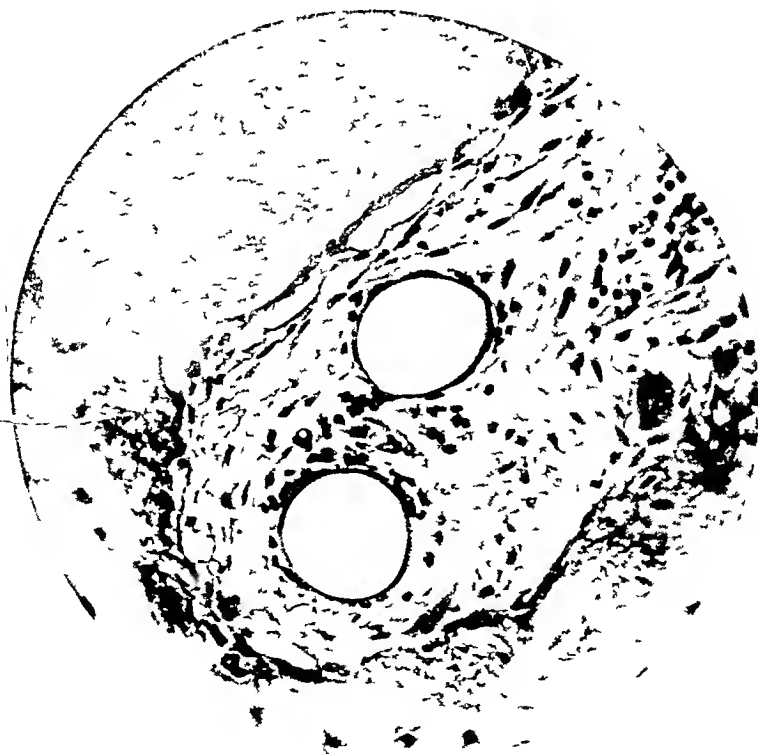
<sup>1</sup> Deutsche Zeitschr f Chir, vol xc, p 480

<sup>2</sup> Vier Fälle von sogen plast Induration, etc, Wiener klin Woch, 1901, No 5



osseous tissue showing Haversian canals and a marrow cavity. In the latter are several giant-cells (osteoclasts?).

FIG 4



Section of marrow canal. The dark area above is calcareous matter, on the right is an osteoclast, to the left and below osseous tissue is seen.



All the cases heretofore observed occurred in men between the ages of forty and seventy-four, except in one (Brohl's), where the condition was present at twenty

Osseous deposits in the penis generally assume the shape of bodies of a lamellary or testaceous form. Very often their continuity is interrupted by round or irregular defects or perforations filled in with connective tissue. Their osseous components are deposits of a very irregular serrated outline. In our case the Rontgen shadow demonstrated that the bony deposit formed a serpentine meander wound about a longitudinal staff, remotely comparable to the Æsculapian symbol. None of the bodies obtained at autopsy or by surgical operation exceeded a thickness of two or three millimetres. Most of them were found occupying the internal aspect of the tunica albuginea of the dorsum, occasionally extending into the septum, the corpora cavernosa, and in Chetwood's case into the erectile parts of the urethra and its anterior extension, that is, the glans penis.

The complaints caused by the disorder are interference with urination and with intercourse, the latter consisting in pain at erection or at seminal ejection. Abnormal angulation or curvature of the penis on the side of the deposit is the rule.

Frangenheim's careful study of the minute processes connected with ossification were fully borne out by our investigations, demonstrating the presence of a well-defined layer of osteoblasts, which are distributed along the anterior circumference of the bodies,—that is, there where extension by growth is mainly observed. The practical conclusion to be drawn from this fact is the importance of removing with the body itself a small portion of the tunica adjoining its anterior extremity. If this is not done, a relapse may follow, as happened in Stromeyer's case.

The changes wrought by age in the human penis were carefully investigated by Schurygin,<sup>4</sup> who found that the

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<sup>4</sup> Über die pathol. anat. Veränderungen membri virilis im Griesenalter, Wiener med. Presse, 1898, No. 44.

# ANTERIOR GASTRO-ENTEROSTOMY.

REPORT OF A CASE OF DIVERTICULA OF THE JEJUNUM

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It is generally conceded that when a gastro-enterostomy is indicated, the posterior no-loop operation is safer, gives the best end-results, and that it carries practically no risks of unfortunate mechanical sequelæ. The method has been so consistently satisfactory that it may have been used at times when other methods would have sufficed as well or perhaps better. It is particularly applicable for benign lesions in the region of the pylorus when a resection of the pyloric end of the stomach is not indicated or some type of plastic operation is not possible.

For various reasons an anterior gastro-enterostomy is the operation of choice in certain definite groups of cases, the largest of which is composed of the obstructions at the pylorus due to carcinoma in which a resection of the growth is not feasible. In many of these cases the mechanical obstruction with retention of decomposed food products and the resulting starvation are the important factors. These patients are not only greatly relieved temporarily by drainage of the stomach but the terminal stages of the malignancy are much less pitiable. It is particularly in this type of case that the anterior method is preferable on account of the speed, safety and simplicity with which it can be performed. A smaller group is composed of certain benign lesions at or near the pylorus where a posterior gastro-enterostomy would be desirable, but not possible because of the presence of certain mechanical conditions. Extensive adhesions, congenital or inflammatory, malformations, etc., may be sufficient to preclude the advisa-



on the mesenteric border of the jejunum and, since they could be collapsed and would rapidly distend when pressure was removed, were definitely connected with the intestine. They evidently were not causing symptoms and were left undisturbed. Examination of the remaining part of the small bowel showed no other diverticula.

The situation and density of the adhesions to the mesocolon and mesentery of the jejunum, the amount of trauma necessary in order satisfactorily to free the jejunum made the posterior operation a questionable procedure, and the anterior operation was decided on. This decision was reached after eliminating the possibility of excision or performing a plastic closure of the ulcer itself, chiefly because of its size and the amount of induration surrounding it.

The anastomosis was made just beyond the three diverticula. Probably the most important step in this operation is directed toward the prevention of a kinking at the line of union between the stomach and the intestine, which would mean obstruction and vicious circle. This step is accomplished by a simple method, namely, the Hartmann modification of the Kappler technic, introducing a suture of linen between the stomach and jejunum about 1 or  $1\frac{1}{2}$  inches beyond the extremity of the outside suture line on each side after the anastomosis is completed. This gives the jejunum an attachment to the stomach of nearly double the length of the actual gastro-enterostomy opening and sharp angulation of the actual opening between the stomach and jejunum cannot take place. This method of hitching up the jejunum has probably been the means of preventing the unfortunate complications which were so common following the earlier methods of anterior gastro-enterostomy and for which an entero-anastomosis was so frequently made as a part of the operation.

The patient recovered and was dismissed from the clinic in good condition, and a letter received recently states that he has had no further trouble.

Examination of the gut near the termination of the cystic process, where as far as could be determined macroscopically there was a transition between minute cysts and normal intestine, showed the following pictures:

The mucosa is almost normal and the lymph follicles much larger than in the intestine heretofore described. The longitudinal and circular muscle is better preserved than in the region containing the cysts. Just outside of the longitudinal coat is new formed tissue forming a band somewhat thicker than the whole of the rest of the intestinal coats. This presents a meshwork, composed of a multitude of spaces, separated in places from the serosa by a thin layer of connective tissue, in others by dense fibroma-like tissue such as was described as forming nodes in other sections. There are areas in which the structure is that of a typical capillary lymphangioma, there being a multitude of fairly large lymphatics with thickened walls. Here and there are found marked dilatations of lymphatics, particularly outside of the muscular coats, forming cavernous spaces of considerable size, lined by endothelium and receiving or dividing into a number of lymphatic channels. Besides these spaces that are indistinguishable from capillaries, there are thin walled, irregularly shaped spaces, containing numerous bacilli, the lining being for the most part devoid of any distinct endothelial structure. In some of the cyst walls, a continuous layer of endothelial-like cells can be distinguished.

Were it not for the presence of the old connective tissue, one would conclude that the sections just described represent the most recent or youngest areas involved in the emphysematous process. It is more probable, however, that the lesion was inconsiderable at these sites and that absorption of the air or gas had taken place, with consequent cicatrization around the air-containing spaces.

Summary of the chief characteristics of the lesions

- 1 Extensive gas cyst formation, for the most part situated outside of the longitudinal muscular coat

- 2 Characteristic appearances of the gas cysts and the cyst walls, in which the presence of an endothelial-like lining and giant-cells is a feature

- 3 Occurrence of spaces or channels, some of which may be lymphatics partly lined by endothelium and partly filled with giant-cells, endothelioid cells, and leucocytes

often seen with rickets, and are distinctly springy when pressed on. The mucous membrane is tense, but otherwise not altered. To the touch the growth feels cystic, or rather as though a cyst or cysts were under a thin lamella of bone.

Slow growing unilateral jaw tumors are not infrequent in colored people and often attain huge size. These are commonly odontomata and are either cystic or adamantine in character. In this case the symmetry and the involvement of both jaws would place it within a separate class. The appearance of the growth subsequent to the eruption of the first teeth would assign it to irritation of all of the dental follicles of the permanent

FIG 1



Odontoma of superior maxillæ

teeth occurring simultaneously and evenly in both jaws. The skiagraphs show very immature and widely scattered teeth of the permanent set.

This child was seen at the Polyclinic Hospital by Drs Hamill, Cryer, Muller, and Bloodgood of Baltimore, and such a condition had not been seen by any of them before.

#### INCISED WOUNDS OF WRIST AND FOREARM

DR MULLER presented a man aged thirty-five, who was admitted to the Polyclinic Hospital, October 22, 1906, with an extensive injury of the left forearm as the result of being struck

angitis is added secondarily. A similar opinion is maintained by Kitt, in his text-book on the "Pathological Anatomy of the Domestic Animals," vol i, 1905.

The disease had often been noted in hogs which were fed on the waste of dairies or cheese factories; and Ostertag, therefore, holds a yeast fungus responsible for its production. The culture of this fungus has not yet proven successful

A liquefying coccus was grown in pure culture by Dupraz,<sup>7</sup> 1897, who explained the cysts as the result of a proliferating lymphangitis due to gas-producing bacteria, which distend the lymphatics, and he claimed to have produced the cyst formation experimentally. Jaeger (1906) isolated from gas cysts of the pig's intestine a species of the colon bacillus, *Bacterium coli lymphaticum aerogenes*, and injected this germ into the wall of animals. A number of very small gas cysts were discovered at the autopsy, in all of the layers of the gut of these animals, which died within 25 hours from general infection. The existing difference from the typical pathological picture of intestinal pneumatosis is referred by Jaeger to the very acute course of his experimental cases.

The chronic course of this affection, which in pigs is restricted to the small intestine, is illustrated by the findings of the Bureau of Animal Industry of the Department of Agriculture in Washington (Dr J R Mohler). A certain importance naturally attaches to the matter from the stand-point of meat inspection, so that the process was investigated and attributed to a micro-organism of the colon group. However, the transmission of the condition by experimental introduction of the pathogenic agent has not apparently been accomplished.

In the human subject, the formation of gas cysts was observed for a long time only in the vagina and urinary bladder of females, almost without exception during pregnancy. Although the condition clinically resembles vaginal emphysema (also known as cystic colpohyperplasia), the appearance under the microscope is somewhat different. Intestinal pneumatosis does not show inflammatory changes of the same severity as those noted in cystic colpohyperplasia. The resemblance con-



(1897) On the other hand, the bacteriological findings of Hahn,<sup>9</sup> in Germany (1899) were not clear but contradictory, microscopical examination showed cocci in the cyst wall, but colonies of short rods grew from sheep serum that had been inseminated with the extirpated air vesicles. Although the rest of the examination proved negative, Hahn advocated the bacterial theory and assumed the transference of the pathogenic agent from infected pigs to the human subject.

Jaboulay,<sup>12</sup> 1901, without submitting any evidence (the cysts in his case were not disturbed in any way) was inclined to refer the condition to a gas-producing micro-organism. In the same year, Miwa's<sup>18</sup> cultures from the cystic contents, on grape-sugar agar, yielded a growth of gas-forming bacteria, but no positive results were obtained in animal experimentation with these germs. He also demonstrated that a number of rods and cocci were present in the cystic walls and cavities. Another adherent of the bacterial theory is Nigrisoli,<sup>20</sup> 1903. Mori<sup>29</sup> originally inclined to the bacterial theory, although no bacteriological examination was possible in his case, 1907. In the following year, 1908, Grondahl<sup>32</sup> expressed himself to the effect that the condition is probably the result of infection with a gas-forming non-pathogenic microbe, which gives rise to chronic lymphangitis and distends the lymph vessels and gaps into vesicles, causing a characteristic macroscopical and microscopical appearance. A species of gas-forming bacteria was held responsible for the genesis of the gas cysts by Jamanouchi,<sup>40</sup> 1909. The pathogenesis was referred to a bacterial agent, by Arzt,<sup>43</sup> 1910, and he also accepted the identical origin of pneumatosis cystoides and colpolhyperplasia cystica. Wasiljew,<sup>38</sup> 1910, endorsed the bacterial theory. Sherman and Wilkie,<sup>41</sup> 1910, found no micro-organisms within the cysts or in their walls, and regarded some cocci and bacilli from interstices between cysts at the lower end of the ileum as the result of contamination of the specimen. A culture with the morphological and biological characters of the *Bacillus coli communis* was grown from cysts removed at the operation. The cultural findings agreed with those of Jaeger, 1906, and of the Department of Agriculture, in Washington, in cases of gas cysts of the pig's intestine. The action of germs (*Bacillus gasogenus*) resulted in the production of the gas, in the opinion of Martini,<sup>46</sup> 1910.

*Mechanical Theory*—The adherents of this theory, the most recent advocate of which is Miyake,<sup>48</sup> 1911, refer the origin of the disease to a process entirely analogous to that of traumatic emphysema. The following facts, according to him, go to show that the genesis of intestinal pneumatosis is referable to mechanical causes, namely, that the intestinal gas escapes from minute ruptures in the bowel wall.

1 Absence of uniform histological structure of the gas cysts

2 Close relationship between the gas cysts and the lymphatic apparatus

wound broke down, discharging pus and urine. She returned to Philadelphia and a second time he attacked this kidney, but again stopped at drainage. Last month he tackled it the third time. She came into the hospital with myocarditis, dyspnoea, etc., and he had her under treatment before the last operation for seven weeks. At the last operation he had loosened the kidney at its superior pole, when in twisting his finger the vena cava was torn in two and in less than a minute the patient was dead.

### SPRAIN FRACTURE OF THE SPINOUS PROCESS OF THE FIRST THORACIC VERTEBRA

DR PENN G SKILLERN, JR, reported the case of a man, aged twenty-two, who, while lifting a heavy object from the ground with both arms, felt something snap at the root of the neck posteriorly. He applied for treatment at the Surgical Out-patient Department of the University Hospital where he was examined by Dr B A Thomas, who made a clinical diagnosis of fracture of the spinous process of the first thoracic vertebra. The signs upon which this diagnosis was based were localized tenderness, preternatural mobility and crepitus. A skiagram (Fig 3) confirmed the diagnosis. It is noted that the spinous process of the first thoracic vertebra is displaced downward from its base of attachment to the body of the vertebra for a distance equivalent to its own diameter, so that the interspinous interval between it and the spinous process of the second thoracic vertebra on the one hand is diminished, whilst that between it and the spinous process of the seventh cervical vertebra on the other hand, is increased.

The text-books merely mention these fractures. Gurlt (Handbuch der Lehre von der Knochenbrüchen, 1862) says "It is known that fracture limited to a spinous process is exceedingly rare." Stimson (Fractures and Dislocations, 1907, p 145) says "Isolated fracture of a spinous process may occur as the result of direct violence, or of *muscular action*, and the displacement is either *directly downward* or to one side. Muscular action is very rare. The spinous processes are broken most frequently at those points where they are longest and thinnest, more than one-half the cases occurring in the thoracic region and often several adjoining ones are broken at the same

held responsible for an increase of gas pressure in the intestine, with penetration of the gas into the tissue.

*Neoplastic Theory.*—This explanation was offered for the first authentic case on record, that of Bang,<sup>1</sup> in 1876. The gas cysts were interpreted by this observer as a new growth, the centre of which had undergone degeneration, followed by liquefaction and a gaseous change of the contents. Kouskow,<sup>4</sup> 1891, referred the cystic tumor found in his case to a congenital origin, the growth arising from the fixed elements of the connective tissue. The theory of tumor growth is strenuously supported by Mair,<sup>30</sup> 1908, who considers the gas cysts as analogous in structure and formation to the air bladder of fishes, and credits the cells of the tumors with the power of secreting gas. This view is endorsed by Finney,<sup>33</sup> 1908, who says that "the most rational explanation of the growth would seem to be that it is a definite entity, a distinct variety of tumor, the cells of which have the faculty of secreting gas."

*Chemical Theory.*—Taken in conjunction with Dupraz's demonstration, in a case of gastro-intestinal emphysema, of a microbe apparently related to the lactic ferments, and probably existing as a saprophyte in water, the following facts in regard to milk are very suggestive. The gases contained in milk are carbon dioxide, oxygen, and nitrogen. These gases are expelled in the course of heating; so that boiled milk has lost almost nine-tenths of its carbonic acid, and about one-half of its oxygen and nitrogen.

Dairymen are familiar with a peculiar gas-formation in milk, shown by a collection of gas vesicles under the cream; such milk is known as fermenting or framing milk. It contains large quantities of gas-producing bacteria, which do not necessarily belong to the coli aerogenous group, but include butyric acid bacteria, yeasts, and so forth. The most important gas producers are the coli aerogenes bacteria, which possess the property of decomposing lactose under the formation of carbonic acid and hydrogen, some being characterized by an especially strong capacity of gas formation. These germs live in large numbers on fodder plants, or the latter may



FIG 4



'Winged scapula' in serratus magnus palsy      Profile view      Position of maximum projection of inferior angle

FIG 5



"Winged scapula" in serratus magnus palsy      Arms flexed      Posterior view      Note fossette just below inferior angle      Note slope of right shoulder

At the present time we have been able to tabulate 49 cases, the present case making the fiftieth. It should be noted that the new list excludes several cases reported formerly, such as Marchiafava's, which, although of much interest as showing great similarity in cell arrangement, contained fluid instead of air. The case reported by Maass, in 1904, appears to us to have been a post-mortem change. Two or three cases, where a delayed autopsy was done, have also been excluded on the ground that the gas cysts which were found were due to putrefaction.

#### ABSTRACTS OF CASES REPORTED IN LITERATURE

1 BANG (*Nordisk Medicinsk Arkiv*, vol viii, No 18, 1876) In a case concerning a woman 57 years of age, who had died from volvulus, the lower portion of the ileum presented a large number of small gas cysts, from the size of a pea to that of a bean, no fluid but gas escaped on puncture of the vesicles. These cysts had a smooth inner surface and were found for the most part in the muscular layer, some also in the submucosa. The wall of the cysts consisted of a layer of fibrillar connective tissue, with an endothelial lining. The endothelial cells were very large and had a finely granular protoplasm, with 30 to 40 nuclei, or over. The newly formed tissue of the intestinal serosa contained cysts of a similar character, having the identical appearance of the above-described cysts. The interstices in the newly developed tissue were lined with cells having exactly the same configuration as the endothelial cells of the cyst wall. Although all transitions were found from these interstices to the extensive cysts, there was no demonstrable connection with the lymphatic vessels.

2 EISENLOHR (*Ziegler's Beiträge zur pathol Anatomie*, vol iii, 1888, p 101) The following case of intestinal and vaginal emphysema was observed in the Zurich Pathological Institute. The patient died from valvular disease of the heart, and came to autopsy four and a half hours after death. A number of intercommunicating cysts, with thin walls, were found in the submucous muscular and serous layers. These cysts were lined with endothelium on the inner surface, and contained numerous giant-cells, they communicated with lymph gaps and lymph vessels. Numerous finely granular collections of bacteria were found in the interior of the cysts as well as in the lymph capillaries and lymph spaces.

3 DE CAMARGO (*Thèse de Doctorat*, Geneva, 1891) At the autopsy of a man 60 years of age, who had died from pulmonary consumption, the cæcum and the ascending colon were found to be much contracted, and thickly studded on the serous surface with a mass of large and small cysts. The cysts occupied exclusively the submucosa. The septa between the individual cysts were in part very delicate but in part quite thick,

sagittally to right angle, and now two fingers could be introduced into the little fossa below the overhanging angle and pushed up as far as their knuckles (2) in the subscapular fossa. A fold of skin ran downward and outward from the inferior angle which projected  $1\frac{1}{2}$  inches from back. It was evident that the unopposed antagonists of the serratus magnus were responsible for the following conditions. The inferior angle had slipped from under the upper border of the latissimus dorsi owing to rotation of the scapula on an anteroposterior axis projected through its centre from contraction of the levator scapulæ and of the rhomboids, so that the acromial angle drooped from gravity and from pull of latissimus dorsi and pectoral muscles, and the lower angle was drawn enough upward and inward to release it from the binding of the latissimus. This resulted in obliteration of the triangle of auscultation and in its stead a cord-like swelling produced by shelving of the lower border of the trapezius. There was no atrophy of the supraspinatus. Elevation of the right arm beyond the domain of the deltoid was incompletely accomplished by the compensatory action of the elevator portion of the trapezius, for the occipito-clavicular and spino-acromial fibres forming its upper rounded border were strongly contracted to such extent that the head was also drawn over toward the lame side. The extremity soon became fatigued and dropped to the side.

It seemed to him that the criterion of unilateral isolated palsy of the serratus magnus must reside in the relations which the angles of the scapulæ bear to the mid-dorsal line in the various rotations of the shoulder-blades. To emphasize this he had prepared the following table

TABLE TO SHOW RELATIONS OF ANGLES OF SCAPULÆ TO MID-DORSAL LINE IN VARIOUS POSITIONS OF THE UPPER EXTREMITIES (Distance Given in Inches)

	R	Upper Angle L	Difference	R	Lower Angle L	Difference
(1) Resting by side	$\frac{1}{2}$	$2\frac{1}{2}$	L + 1	2	$2\frac{3}{4}$	L + $\frac{3}{4}$
(2) Flexed forward to right angle	$2\frac{1}{2}$	$3\frac{1}{2}$	L + 1	2	$5\frac{1}{2}$	L + $3\frac{1}{2}$
(3) Abducted to right angle	2	$2\frac{1}{2}$	L + $\frac{1}{2}$	$1\frac{1}{2}$	$5\frac{3}{4}$	L + $4\frac{3}{4}$
(4) Vertical elevation	$1\frac{1}{2}$	2	L + $\frac{1}{2}$	$2\frac{1}{4}$	7	L + $4\frac{3}{4}$

From this table a graphic chart (Fig 6) has been prepared which shows at a glance the excursions of the superior and

remnants of cellular necrosis on their wall, while the lymphatics of normal calibre were in a state of endothelial proliferation (proliferative chronic lymphangitis).

8 KOLLI (*Russki Vrach*, September, 1895; *Lubarsch-Ostertag*, vol v, 1898, p 212): In a fatal case of gastric ulcer, numerous vesicles filled with air, and varying in size from a pin's head to a walnut, were found under the serosa of the duodenum and the adjacent coils of small intestine

9 HAHN (*Deutsche med Wchschrft*, 1899, p 657) The patient was a man 35 years of age, who after suffering for two years from a stomach disease supposed to be gastric ulcer, began to present symptoms of intestinal trouble, in form of prolonged diarrhœa, later on replaced by persistent obstipation, there was also a sensation of fulness with anorexia and progressive emaciation. Soft, elastic, painful resistances could be felt under the sternum and in the abdomen. Operative interference finally became necessary, and the laparotomy showed the larger part of the small intestine as well as the entire colon to be closely studded with countless cysts, from the size of a pea to that of a bean, partly pedunculated, partly attached by a broad base to the serosa. The cysts contained exclusively a non-combustible gas, but no fluid, compression caused them to burst, with an audible noise. As the cysts could not be radically removed, a number were compressed and burst open between the fingers.

The patient visibly improved after the simple laparotomy, and was discharged in good condition, at the end of about seven weeks.

10 KORTE (*Discussion of Hahn's paper, Dtsch med Wchschrft*, 22, 1899, p 255) At the autopsy of a woman 62 years of age, who had died under symptoms of peritonitis seven days after a hernia operation, the walls of the small intestine were found to contain a number of sharply outlined cystic tumors, from the size of a pea to that of a cherry. Bubbles of air escaped from these cysts when they were cut open under water. The microscopical examination showed the site of the cysts to be the intestinal submucosa.

11 WIKERHAUSER (*Centralblatt fur Chnurgie*, 1900, No 37, p 938). In the case of a patient 35 years of age, who had suffered for ten years from gastro-intestinal disturbances, laparotomy showed beside pyloric stenosis, a number of globular clusters of cysts, from the size of a hemp-seed to that of a small cherry, studding the small intestine. The vesicles were either attached separately by a small pedicle opposite to the mesentery, or they were arranged in large or small groups, surrounding almost the entire periphery of the bowel. In color these cysts were reddish or bluish, transparent or white, traversed by fine capillaries. They crepitated under the finger, and were inflated with air. Some of the growths were extirpated for microscopic examination, which showed that the internal surface was mostly lined with normal endothelial cells, hypertrophied, and arranged in two to three layers. When the patient came to autopsy, having succumbed to peritonitis about two months after the operation, not a trace was left of the pneumatosis in the entire abdominal cavity.

12 JABOULAY (*Lyon Médical*, vol xcvi, 1901, p 753) In the course of operation upon a man 50 years of age, with a history of eight years'

inferior angles and most strikingly of the intervening vertebral border of the scapula from the mid-dorsal line. By connecting the respective dots on the right (lame) side it is seen that the vertebral border remains almost vertical, or parallel with the mid-dorsal line, in all positions, whilst on the left side the inferior angle is constantly carried well forward and outward with coincident increasing degrees of obliquity of the vertebral border until in vertical elevation of the limb this border forms a wide angle with the mid-dorsal line, the inferior angle reaching almost to the mid-axillary line. In fact, by actual measurement the left half of the chest from the mid-sternal to the mid-dorsal line was 16 inches, and 7 of the 16 inches, or just less than half, were traversed by the inferior angle of the sound scapula during its excursion outward and forward. The extent of the excursion of this inferior angle is not ordinarily appreciated, and the contrast on the two sides, in conjunction with the visible and palpable atrophy of the lower digitations as seen on the side of the chest, furnishes the most convincing proof that the serratus magnus is the muscle affected, and that it is pathognomonic of this malady.

With the arms folded across the back no abnormal deviation of the lamed scapula was noticeable, since here the rhomboids exercised their normal and unopposed function of adducting the vertebral borders of the scapulæ toward the mid-dorsal line and therefore toward each other.

By way of exclusion the patient was examined for progressive muscular dystrophy, so commonly localizing in the shoulder region, with absolutely negative findings. To exclude cervical rib, a skiagram was taken by Dr Henry K Pancoast, but no supernumerary rib was found. To exclude syphilis, a Wassermann reaction made by Dr John L Laird was negative. Dr Alfred Reginald Allen very kindly made tests of the long thoracic nerve and serratus magnus muscle with both the faradic and galvanic excitors, with in both cases the reaction of degeneration.

Acting upon the diagnosis of isolated paralysis of the right long thoracic nerve of Bell due to traumatism with sequential atrophy of the serratus anticus muscle, the treatment advised was cessation from work, tri-weekly massage with passive movements, active graded gymnastics, and ascending doses of sulphate

experiments (intra-peritoneal cultures in two rabbits and two dogs) had a negative outcome

17 VERLBYLY (*Wiener medic Wchschrift*, No 47, 1901, p 2218) Pneumatosis cystoides of the intestine, involving four coils of the ileum and the entire cæcum, was discovered as accidental findings in the autopsy of a man 30 years of age, who had died from pulmonary consumption and also had tuberculous abscesses in the intestine. The vesicles were in part attached by a pedicle, and in part with a broad flattened base. The mucosa was likewise infiltrated by innumerable vesicles, which contained an odorless, non-combustible gas. The microscopical examination showed the main seat of the cysts to be in the intestinal submucosa.

18 KADYAN (*Russ Chin Archiv*, H 6, 1902, *Centralblatt f Chirurgie*, No 10, 1903, p 300) The following case was observed by the author in 1893. The patient, a woman 31 years of age, had been suffering for two years from abdominal pains, vomiting, alternate diarrhoea and constipation, and ascites. At the time of the laparotomy the intestinal serosa, especially of the small gut, was seen to be irregularly studded with tubercles of variable size, as well as air-containing vesicles up to the size of a plum. The condition was at first improved, but the operation had to be repeated about two and a half months later, the solid tubercles had disappeared, but there were again many air-containing vesicles, which were punctured and emptied or cut off after ligature of the pedicle, as at the first operation. At the third laparotomy, two months later, whitish spots were seen instead of the tubercles, again, there were numerous air-containing vesicles and a large amount of ascitic fluid. Considerable improvement again followed upon the operation.

Microscopical examination of the cysts showed fibrous walls lined with one or more layers of large endothelioid cells.

19 THORBURN, W (*Med Chronicle*, Manchester, vol iv, 1902-3, p 255). Gas-containing cysts were found in the omentum of a woman 42 years of age, who had suffered for ten years from dyspepsia and recurrent vomiting. At the operation were found gastric ulcers, perigastric adhesions, an enormous dilatation of the stomach, and two collections of rounded cystic masses, lying like saddlebags across the omentum, and extending into the right hypochondrium, or beneath the spleen, respectively. The numerous cysts varied in size from that of a small pea to that of a walnut, and were closely packed together in form of a cone, resembling a cluster of hydatids. Each little cyst had a thin, transparent but well-defined wall, some contained a thin, almost colorless fluid, but the majority were filled with an inodorous gas. The first mass which came into view was excised, but the collection on the left side was left behind, as there was evidently no malignancy. The patient recovered from the operation, but died about ten days after her discharge, presumably as the result of hemorrhage from an unhealed ulcer.

20 NIGRISOLI (*Nuovo Raccogliore medico*, Sept, 1902) Gas cysts were discovered in the course of gastro-enterostomy upon a young man, aged 25 years, on account of cicatricial pyloric stenosis. Numerous

seeming elevation of the lame arm higher than the shoulder is more apparent than real, and is very weak and wavering, it being due as aforementioned to compensatory action of the elevator (spino-acromial) portion of the trapezius

Conservative measures are being thoroughly tried out in this patient because he reported early for treatment, and the earlier a case is treated with electricity the more favorable are the chances for its restoration. Again, experience with similar cases by others has shown that those cases are apt to heal in which an overstretching of the shoulder muscles is at the bottom of the palsy, and also complete restoration has been produced by the faradic current in cases that have existed many years. With these measures he may expect a certain degree of improvement, but in all probability a permanent lameness of the arm with the characteristic deformity

The prognosis, however, must not be based so much upon the behavior of previous similar cases as upon that of the case that confronts us. It depends upon the severity of the anatomic lesion of the nerve, the nutritional state of the paralyzed muscle, and the extent of secondary changes in its antagonists. Further, complete absence of reaction of the nerve and muscle to both currents makes the prognosis absolutely bad and almost always means the case is incurable.

The crux of this case is the textural condition of the long thoracic nerve, and of the four possibilities,—concussion, compression, contusion and laceration—the probability, based upon the clinical findings, is laceration with separation and with interposition of scar tissue between the dissevered ends. This being the case, no amount of electricity, massage or other measures will remove that scar tissue. The lesion is on a small scale akin to traumatic rupture of the brachial plexus and should be dealt with accordingly. It is for these reasons—and mainly to restore a useful arm to this man entering upon his wage-earning life—that Dr Skillern has planned and recommended the execution of the following operation.

*Operation*—It is evident that the only operative procedure to be considered here is that of inosculating the proximal end of a healthy nerve to the distal end of the injured long thoracic. In casting about for a nerve that would fulfil the requirements of equal size, identical origin and close proximity, it occurred

tained an odorless, non-inflammable gas Part of the mass was removed for examination, with the same findings as in the first case

25 VISCONTINI (Gazz degli Ospedali, No 118, 1904, p 1249) Transparent gas-containing cysts were found on the intestine, mesentery, and parietal peritoneum of a girl 13 years of age, in the course of a second laparotomy on account of dilatation of the stomach after pyloric stenosis New vesicles were seen to form as the hand was passed over the peritoneum, while some of the cysts coalesced into a tumor the size of a hen's egg The gas had no odor of hydrogen sulphide Microscopical examination of the excised specimens showed a solid layer of connective tissue, with a few endothelial cells at the inside of the cysts Recovery

26, 27, 28 LUBARSCH (*Verhdlg d dtsch Pathol Gesellschaft*, x, 1906, p 256) Three cases of gas cysts of the large and small intestine in human beings, which were carefully examined, presented the typical histological findings of lymph cysts with giant-cell formations Bacteria were not demonstrable by means of any method.

29 MORI (*Dtsch Ztschrft. f Chir*, vol xxxviii, 1907, p 553; vol xci, 1907-8, p 620) The patient, a man 37 years of age, was operated upon under the diagnosis of gastric dilatation beside which the following condition was discovered along the entire course of the small intestine Except the first portion of the ileum and the terminal portion of the jejunum, the intermediate segment was studded with countless air vesicles, from the size of a hempseed to that of a hazel-nut, partly attached by a broad flattened base, partly suspended from a pedicle The cysts were arranged in groups or scattered separately A segment of intestine with gas cysts was reserved for histological examination, which showed the absence of an endothelial lining to the cysts

After being considerably improved by the gastro-enterostomy and enterostomy, the patient had a relapse of his old disturbances, and returned for operation eight months later At this time, all the innumerable cysts had disappeared absolutely, except two small hydatid vesicles with serous contents

30 MAIR, W (*Medical Chronicle*, March, 1908, p 422) In the course of operation upon a young man (gastro-enterostomy for pyloric stenosis) the small intestine was found to be covered with a cystic tumor mass, for a distance of about nine inches, these cysts were separate from each other and varied from a barely visible size to that of a walnut On puncture most of the cysts collapsed, under escape of an odorless gas A few vesicles contained a small amount of fluid The microscopical examination showed an endothelial lining in a number of the cysts, with multinuclear giant-cells lying free in the cyst cavity and also in the cyst walls

31 MITCHELL (Quoted by Mair, *Med Chronicle*, xiv, 1907-8, p 422) Gas-containing cysts were found in the performance of a gastro-enterostomy for pyloric obstruction on a young man. Resection of the affected segment of small intestine was followed by recovery

32 GRONDAHL, N B (*Dtsch med Wchschrft*, No 21, 1908, p 913) The patient was a man 31 years of age, healthy until six years ago, when





cæcum and ascending colon. The elevations as well as the interstices presented an enormous number of uniformly scattered round vesicles, which contained gas and had a diameter up to 5-6 mm.

(3) Kucera's case. This observation was made on a man 39 years of age, who had died from pulmonary tuberculosis. The process was limited to the transverse and descending colon, the vesicles were located in the mucosa and submucosa, reaching an average diameter of 4 mm. The serosa presented no visible changes.

37 HERMAN (*Lek Gal Tyg lekarski*, No 8, 1908, p 118). In this case, which is quoted by Nowicki as having been demonstrated before the Przemyszlau Galicia Medical Society, the intestinal pneumatosis had developed as a sequel to gastric ulcer.

38 VASLYEFF (Wasiljew) (*Centralblatt f Chirurgie*, No 16, 1910, p 594). The patient, six months after appendectomy for acute appendicitis, began to suffer from pain in the cæcal region and intestinal disturbances. Laparotomy was performed, under the assumption of adhesions, none were found, but the lower end of the small intestine was distended by numerous gas cysts, lined with peritoneum, which burst and disappeared on pressure. Resection of the affected segment, 7 cm in length, was followed by recovery.

The mucosa of the resected intestinal segment was unchanged, the submucosa was thickened and interspersed with gas-filled cavities, the muscular layer was fairly unaltered, the bulk of the gas cysts occupied the serous layer (lymphangitis proliferans).

39 WOLTMANN, A. N. (*Centralblatt f Chirurgie*, No 17, 1909). The patient was a man 37 years of age, who presented the symptoms of chronic appendicitis. The appendix was removed, but five months later the pain returned and remained constant. Laparotomy showed the absence of adhesions. A tumor, consisting of gas vesicles, was found on a coil of small intestine, at the side opposite the mesentery. The vesicles were separated from one another by peritoneal septa, and communicated in such a way as to give the tumor the appearance of a hydatid mole. An isolated vesicle was found higher up on the peritoneum. The affected segment of intestine was resected, and the isolated vesicle was crushed.

40 JAMANOUCI (*Verhdlg d Japan Gesellschaft f Chir*, 1909). Laparotomy was performed upon a patient 29 years of age, who since his seventeenth year had suffered from gastric disturbances, leading to the diagnosis of pyloric and intestinal stenosis. In addition to gastric dilatation, due to cicatricial pyloric stenosis, a number of gas cysts were found in two segments of the small intestine, one 100 cm and the other 70 cm in length.

41 SHENNAN, TH., WILKIE, D. P. D. (*Journ of Pathology and Bacteriology*, vol XIV, 1910, p 259). At the operation of a man 32 years of age, masses of gas cysts springing from the wall of the ileum were observed, besides pyloric stenosis, with a dilated and hypertrophied stomach, the patient died 30 hours later. The post-mortem examination showed a mass of closely set, thin-walled, transparent cysts, varying in size from

## ULTIMATE OUTCOME OF SUPERFICIAL COLLATERAL CIRCULATION IN A CASE OF POST-TYPHOIDAL THROMBOPHLEBITIS OF THE INFERIOR VENA CAVA

DR SKILLERN gave the later history of a case which was first reported in detail in the ANNALS OF SURGERY (1912, lv, 6, p 919) and the condition of the superficial abdominal veins at that time is reproduced in the accompanying cut (Fig 8). They have been present ever since an attack of typhoid fever, three years ago. Several months ago, following immediately an attack of acute tonsillitis, the patient noticed that the veins over the right half of the anterior abdominal wall had become reddened and painful. Examination at this time revealed acute thrombophlebitis with its classical picture of a broad streak of dusty redness, swelling, local heat, tenderness, and cord-like tenseness of the superficial veins over the right half of the anterior aspect of the trunk between the right inguinal furrow and the axilla. After a few days of treatment by rest in bed, catharsis, mercury thrice daily, and local applications of lead-water and alcohol, the acute phlebitis subsided, leaving small thrombi here and there along the course of the veins, and shortly afterward these thrombi disappeared and no trace of any dilated veins could be seen (Fig 9). After this the same process was repeated on the left side, likewise resulting in disappearance of the veins, with the exception of the lower part of the thoraco-epigastric vein just above the middle of left Poupart's ligament. This had always been the largest and most tortuous vein, and a hard thrombus remained in it.

The pathology here seems to be clearly explained by metastatic infection of the chronically-congested vasa vasorum by bacterial emboli carried by the blood-current from the primary focus in the tonsil to the *locus minoris resistentiæ*. The minute thrombi arising from its bacterial invasion of the vasa vasorum migrated by continuity into the larger dilated and weakened superficial veins, whose walls they nourished, and gave rise to the macroscopic acute thrombophlebitis, which later extended over to the left side more likely through the superficial than the deep veins, for had the common iliacs been invaded there would have been milk-leg, which did not arise. During the temporary occlusions of these veins by the thrombi the blood current was forced into the deeper para-vertebral channels,

lined with peritoneal epithelium and communicating with the peritoneal cavity

44 SIMMONDS (Discussion of Arzt's case at the fourteenth meeting of the German Pathological Society, Erlangen, April, 1910) A similar observation was referred to in a patient suffering from gastric ulcer

45 URBAN, K (*Med Wchschrft*, No 30, 1910, p 1750) The patient was a girl of 13 years, and the diagnosis of tuberculous peritonitis was rendered on the basis of the clinical findings At the time of the laparotomy, half a litre of clear serous fluid escaped No nodules were seen on the bowel or peritoneum, but the entire small intestine, the cæcum, and a piece about 20 cm in length of the ascending colon were much distended, and the wall was interspersed with countless transparent, not communicating, vesicles, from the size of a pea to that of a hazel-nut, which caused the serosa to bulge, and gave it a roughened appearance The vesicles collapsed on puncture, with escape of an odorless gas, apparently non-combustible Lit in the dark, in larger quantities, this gas was seen to burn with a faint blue flame The mesentery as well as the parietal peritoneum were entirely free from vesicles The mesenteric glands were enlarged but not caseated

Further intervention, such as enterostomy or resection, was omitted, in view of the extensive distribution of the process At the relaparotomy, seven weeks later, nothing remained of the vesicles, but the serosa was covered with an enormous mass of light nodules, resembling millet seeds, which occupied the place of the former vesicles Only a piece about 50 cm in length of the lower jejunum was closely studded with cysts and very sharply outlined from the rest of the bowel This segment was excluded by entero-anastomosis

The histological examination of several extirpated cysts showed the vesicles to lie in the submucosa, pushing apart the mucosa on the one hand and the annular and longitudinal muscle on the other, they were lined with flattened endothelial cells or giant-cells

46 MARTINI, E (*Giornale della R Accad di Medicina di Torino*, Nos 3, 4, 1910, p 129) In the course of an operation for supposed benign pyloric stenosis, a new formation of cystic appearance came into view, covering a large portion of the intestine The findings consisted in soft greyish or pearly masses of variable size, more or less pedunculated, and crepitating on pressure, these masses consisted of a variable number of light round cysts, transparent like soap-bubbles, from the size of a millet seed to that of a pea The cystic new formation occupied only the convex portion of the bowel, and involved the entire length of the ileum; the calibre of the intestine was unchanged

Macroscopical examination of some excised masses showed these to be formed of a conglomeration of thin-walled vesicles, which were united by highly vascularized connective-tissue septa These vesicles floated on water, and an odorless, non-inflammable gas escaped when they were incised

Microscopical examination showed a supporting connective-tissue framework, containing numerous enlarged capillaries, with the character-

FIG 9



Subsidence of enlarged superficial abdominal veins three years after acute metastatic thrombophlebitis occluding inferior vena cava

the contraction of the flexors of the thigh began and continued until the present time. The leg is flexed at about an acute angle (Figs 26, 27 and 28)

*Examination*—The skiagram showed a bony ankylosis of the tibia and femur and of the patella and femur. This ankylosis undoubtedly was the result of a metastatic arthritis from her pharyngeal infection (Fig 24)

*Treatment*—A transverse incision was made to expose the knee-joint. The patella was chiselled free from the femur and dislocated outward, leaving the quadriceps tendon and the tendon patellæ attached. A portion of the vastus externus was detached so as to allow the outward luxation of the patella. Two lateral interposing flaps were then prepared and the tibia chiselled free from the external condyle first and the internal condyle next, maintaining the natural conformation of the femoral condyles. Five-eighths of an inch of the upper end of the tibia was then removed, together with the semilunar cartilages, and the natural conformation of the articular surface of the upper end of the tibia was then secured with a curved chisel. An intercondyloid ridge and spine was maintained in an exaggerated degree. The osseous deposits over the articular surfaces of the condyle were then removed and a full normal anatomic conformation of the femoral condyles was reproduced with a chisel. The lateral flaps were interposed across the head of the tibia and sutured to the crucial ligaments and posterior portion of the capsule. The limb was then straightened out, the patella brought back to the mid-line and rotated 180 degrees, so as to place its bursa and fibrous capsule in contact with the articular surface of the femur. The vastus internus was sutured to the external margin of the rotated quadriceps tendon and the vastus externus was sutured to the internal margin of the rotated quadriceps tendon. The skin incision was then closed with horsehair sutures and without drain.

*Result*—Primary union followed. Motion was instituted in this case more rapidly than is usually done following arthroplasty, and the result is excellent (Fig 25). Sixteen months after the operation the patient had full extension and complete voluntary flexion of the leg (Figs 29, 30 and 31)

One year after the operation the patient wrote that she had splendid motion in the knee, that she did not limp, could climb stairs, and had a strong joint with full voluntary motion

tarsal luxation. In a very extensive monograph Houzel (*Thèse de Paris*, 1911) reviewed the literature up to 1911, and went into the minutest detail concerning the mechanism and other features. He alleged to have found 34 cases. At about the same time, however, Paul Mueller (*Fortschr. a d Geb des Rontgenstrahlen*, 1911-1912, XVIII, p 187) sifted the literature much more carefully, selecting those cases only which had been confirmed by skiagram or by autopsy. With these provisions just 12 cases, including one of his own, passed muster. Goebel (*Archiv. f. Orthop*, 1912, XI, p 9) thought to add one more to this last, but his case must be omitted from classification because it was almost a pure dorsal double luxation of the scaphoid, which carried with it the internal cuneiform alone, instead of the entire forefoot. The present case, therefore, is the thirteenth instance of this rare injury.

Corson (*ANN SURG*, 1912, LVI, 6, p 883) gives a discourse without conclusions about "Mediotarsal Subluxation as Shown by the X-ray," and examination of the skiagrams shows that the first was taken with the foot in plantar flexion,—a position we employ in surgical anatomy to make prominent the head of the astragalus as a bony landmark upon the dorsum of the foot, and also in a Chopart amputation to facilitate entrance of the scalpel into the dorsum of the joint. Corson was deceived by the natural widening of the joint-line under these circumstances, for the next skiagram (after reduction (?)) shows the foot at right-angle to the leg, in which position the joint-line is reduced to a chink.

The midtarsal or Chopart's joint, more recently well-designated by Fick the "transverse tarsal joint," is formed by the os calcis and astragalus behind articulating, respectively, with the cuboid and scaphoid before. The calcaneo-cuboid joint is firmly bound by the long and short plantar ligaments supported by the tendon of the peroneus longus, so that its mobility is reduced to a minimum. At the astragalo-scaphoid joint a composite socket is formed for the head of the astragalus by the sustentaculum tali behind, the scaphoid before, and in between by the upper cartilaginous surface of the inferior calcaneo-scaphoid ligament, which is short and very thick and one of the strongest in the body. This ligament as well as the joint is stoutly supported by the inserting tendon of the tibialis

Thus it would appear, concluding from the reported case and from the examination of our own pathological specimen in which obliteration of the cysts can be seen in many areas that the condition is self-limiting, with a tendency to spontaneous cure. Therefore, if the predisposing cause be treated there is no indication for resection of the affected bowel or even an attempt at removal of the cysts.

In conclusion I wish to express my thanks to Dr. L. C. Buerger, of New York, for his complete and thorough examination and pathological report of the specimen furnished him from the case reported, and especially I wish to thank Dr. F. A. Robbins for a most exhaustive search of the literature and much help in preparing the abstracts





urine at this time was still bloody. The urinary examination on both sides was similar. Neither contained white blood cells, red blood cells, or bacteria. There were a few hyaline casts present on both sides, no albumin. Urea 15 grams to the litre on both sides. Functional test, phenol-sulphonephthalein was given. Six milligrams of the drug were injected hypodermically.

Time of Appearance; left side, eight minutes. first hour, 18 per cent, second hour, 13 per cent, right side, nine minutes. first hour, 15 per cent, second hour, 12 per cent

These findings seemed to substantiate the idea that the symptoms were entirely referable to the prostate, seminal vesicles and deep urethra. Not satisfied about the renal condition, ureter catheterization was again done with the same result as before, with the exception that a few red blood cells were found on centrifugalization. Patient was put on routine prostatic treatment with massage, irrigations, dilatations with the Kollman dilator, and applications to the verumontanum with silver nitrate. In three weeks he had greatly improved, the urine had cleared entirely, was free from blood. The prostate had decreased in size and the secretion contained fewer pus cells and only an occasional red blood cell. Five weeks after the institution of the treatment, the backache and suprapubic ache, and pains in the right hip had entirely subsided, urination free, voided every four hours, gain in weight five pounds. Cystoscopic examination at this time showed that the median rounding had greatly diminished in size and that there was only 20 c c residual urine. His only complaint at this time was soreness and an occasionally throbbing in the right side, beneath the costal margin. He was sent to Dr. Carman for a radiograph, and after a thorough fixation of the kidney with the Luffa sponge, the picture showed a very faint shadow in the region of the renal pelvis on the right side. On the strength of this picture and the finding of a few red blood cells in the centrifugalized specimen of the previous ureter catheterization, a right lumbar nephrotomy was done.

*Operation*—Gas-ether anæsthesia. Oblique lumbar incision through muscles and fascia. Kidney slightly adherent at the lower pole. Delivered and was found slightly enlarged, particularly at the lower pole, which showed a slight rounding as in Fig 1. Kidney was opened by the silver wire method suggested by Broedel. The lower pole of the kidney did not open in the

imprint, whilst on the dorsum the head of the astragalus and anterior extremity of the os calcis form prominences over which the extensor tendons course just as the bridge of a violin raises its springs

The diagnosis is based upon the clinical findings in conjunction with the skiagram. If great swelling interferes with a satisfactory examination, the lesion may be *suspected* and diagnosis made by skiagram.

As associated lesions there may be sprain fracture of adjacent tarsal bones, compression-fracture of the os calcis, compounding through the skin, and from the great swelling and hemmed-in extravasation thrombosis followed by gangrene of the foot and leg. Late lesions, especially if unreduced, are tarsitis with osteophyte formation, retraction of tendons and muscular atrophy. The prognosis is good after proper reduction.

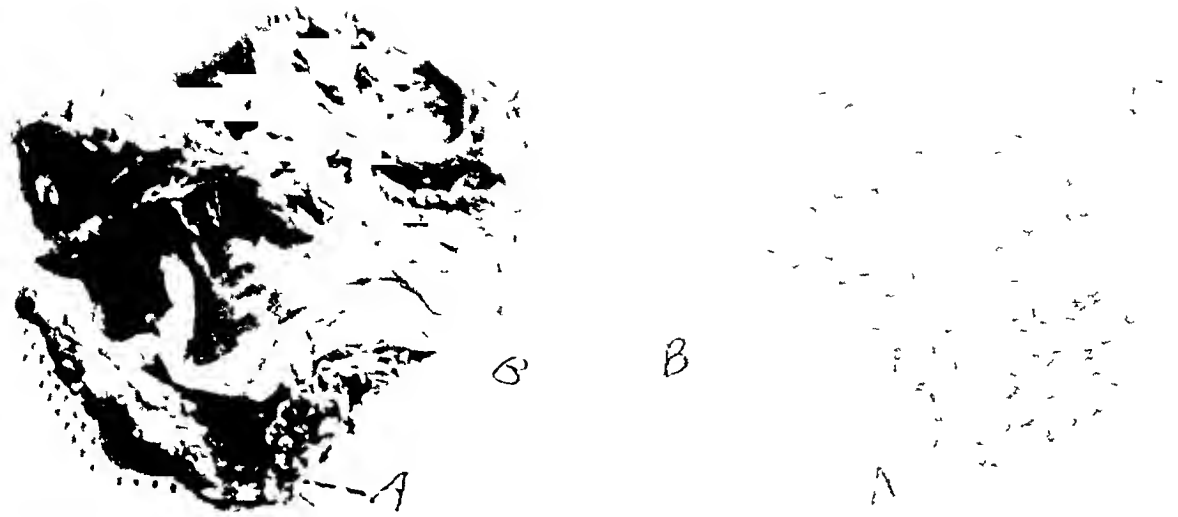
Treatment consists in immediate reposition, preferably under anæsthesia. The posterior tarsus is immobilized and the antetarsus manipulated according to the variety of the luxation so as to retrace its emergent path. It is a matter of judgment and patience. Vanverts thus succeeded in reducing a luxation of two weeks' standing.

Some cases are irreducible at the outset. For these and for poorly-functionating old cases operation is indicated. Even at operation there may be considerable difficulty in locating the obstacle to reduction. In old unreduced cases with poor functional result the operation of partial anterior tarsectomy, in which the scaphoid alone is removed, reduces the luxation and re-establishes the arch.

After reduction by either bloodless or operative measures regard must be had for the weakened plantar arch. In the present case a gypsum cast was applied immediately after reduction and three weeks later a flat-foot shoe. He was a poor risk against flat-foot both because of his race and because of weakening of the calcaneo-cuboid joint from sprain fracture of the inferior articular edge of the os calcis from the pull of the important plantar ligament.

FIG 3

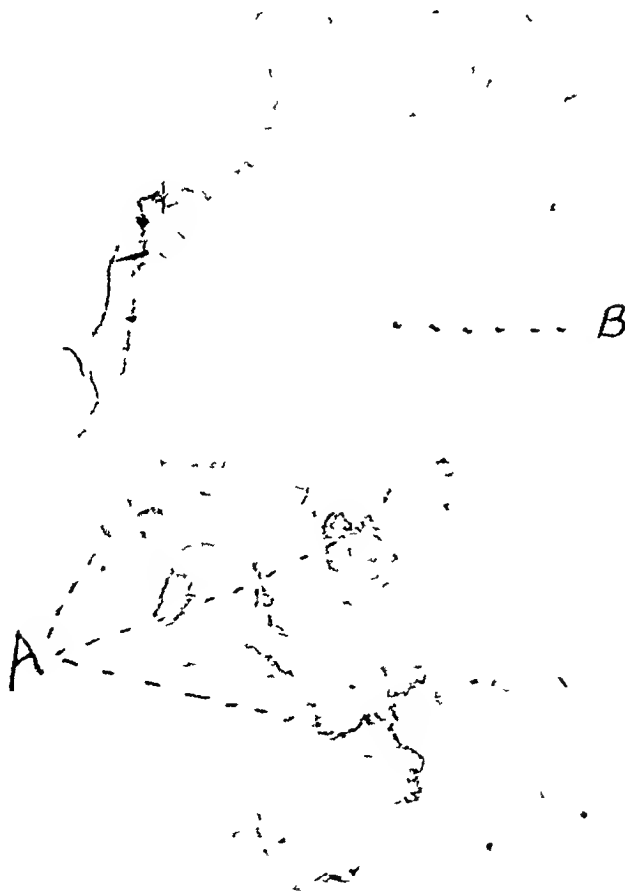
FIG 2



Anterior view B, cyst lining, A, papilla with incrustation

Posterior view of Fig 2 B cyst wall, A papilla with incrustation

FIG 4



cut with an osteotome or saw, and the loose piece of zygoma with its attached masseter, the fat, and ramifications of the facial nerve were pulled down. This gave excellent access to the sphenomaxillary fossa. The idea of the operation was to avoid absolutely the facial nerve, which no other operation would do.

In this case, Dr. Lihenthal said, the chisel had to be used instead of the Gigli saw, and a portion of each zygoma had to be sacrificed. On the left side, the condyle was still covered with smooth cartilage, although there was dense exostosis from the inner aspect of the zygoma, impeding motion. The overgrowth of bone filled the glenoid fossa and embraced the condyle. All of this new bone was removed, but the neck of the mandible was not cut through. In removing the exostosis with the chisel, the cranium was opened at one point so that the dura was exposed. On attempting to separate the teeth, it was found that little if anything had been gained, and the right side was immediately attacked. Here the overgrowth of bone completely hid all the landmarks, so that orientation excepting of the roughest kind was impossible. A wide resection of the neck and part of the ramus of the jaw was here performed, after most of the new bone had been removed with chisel and gouge. Immediately there was free mobility, so that the teeth could be separated for more than an inch. The vertical incision was then extended, and a flap of temporal fascia with the attached fat was mobilized and inserted between the moving parts and held in position by a suture. The left side was again exposed and the same procedure repeated, omitting, however, the extension of the incision.

For some days after the operation there was great swelling of the face, and some slight infection of the wound. A large cork was held between the teeth so as to prevent immediate contraction, but in a few days after the operation the patient could open and close his mouth perfectly. He was still compelled to wear the cork for some hours each day, and this would have to be continued for at least a year. The wounds were now completely healed, and function was excellent.

Dr. Lihenthal said this was the fourth case of ankylosis of the jaw that had come under his observation. In two of these the deformity was due to scarlet fever. In the two others it was due to fracture of the neck of the jaw on each side. In three out of four cases where he had done this operation, it had proven

nephrotomies Left the hospital on the twenty-second day Wound entirely healed He was free from pain in his right side and gradually gaining strength Patient was seen several weeks ago, says he feels perfectly well, is not suffering any pain whatever Attends to hard farm work, urinates normally, has never passed blood since the operation, and has gained twenty pounds in weight

*Pathology*—Specimen consists of mass about the size of a small walnut, pyramidal in shape, tensely fluctuant, walls quite firm and at the tip there is a brownish calcareous material which covers it, as in Figs 2 and 3 Specimen corresponds to one of the kidney pyramids with an incrustated papilla On opening the mass, about a teaspoonful or more of clear amber-colored fluid escaped, which unfortunately was not saved for chemical analysis However, it was found to be slightly alkaline in reaction Sections were preserved in formalin 4 per cent and blocks were made, one block was taken comprising the cyst wall and the tip of the papilla, which was incrustated with the calcareous material This was decalcified in 5 per cent nitric acid Other blocks were made from the different parts of the cyst wall All blocks were mounted in paraffin, stained with hematoxylin and eosin A chemical analysis of the incrustation, made by Dr Shaffet, Professor of Biological Chemistry, showed it to be composed almost entirely of calcium phosphate

*Microscopic Examination*—Section of the decalcified specimen made through cyst wall and papilla with the incrustation shows that the tip of the papilla is covered with homogeneous material which takes the deep blue stain of decalcified material, Fig 4 This material projects into the substance of the papilla as can be seen in Fig 4 The tissue of the papilla is dense and fibrous and contains very few cells In immediate contact with this homogeneous material the tissue has undergone hyaline degeneration In this hyaline area, as the calcified mass is approached, numerous minute calcified granules are seen Deeper in the substance of the papilla the tissue is looser in texture and numerous small blood-vessels are seen There are also occasional collections of lymphoid cells The cyst wall is composed of dense connective tissue which in places is homogeneous It has neither epithelial nor endothelial lining It contains many dilated blood-vessels Beneath the fibrous wall the spaces vary much in size and shape The tissue contains numerous tubular structures lined by cubical epithelium corresponding to the renal tubules Some of the spaces are lined with flat cells with deep staining nuclei, others with various gradations between flat and high cubical There are several large cystic spaces in the wall, lined in places by flat epithelium and in other places destitute of any epithelial or endothelial lining Their lumina contain desquamated epithelium and red blood cells The inter-vascular tissue between the tubules contains lymphoid cells The interstitial tissue is increased in places and there is considerable blood extravasation There are no signs of any proliferation of epithelium or

injury to the kidney, pyelotomy was done instead of nephrotomy, and a mass of semisolid dark red material, which filled the entire pelvis, was removed. On immediate microscopic examination, this proved to be fibrin. The kidney was then explored with the finger passed into its pelvis and nothing abnormal could be felt. The kidney was then decapsulated since the hæmaturias of unknown origin or nephritic origin have been frequently benefited by this procedure. A small piece of kidney cortex was removed for microscopic examination. The wound was then closed, with drainage.

The post-operative course of the case was uneventful. The blood in the urine gradually diminished, and on December 27, six weeks after the operation, the centrifuged urine showed but a few red blood-cells. There was thus a slow rather than a rapid cessation of the hemorrhage. On January 15, 1913, there was no further bleeding, and the patient improved markedly in health. Within the past few days, however, a small amount of blood was again present in the urine.

The pathological report, made by Dr. Hughes Dayton, was as follows: The specimen consists of a section of the cortex and part of the medullary rays of the kidney. The capsule was irregularly thickened, and large and small bands of connective tissue extended from it between the tubules of the cortex. There was marked connective-tissue infiltration of large areas of cortex. There were extensive patches of round-cell infiltration of the cortex, involving also the tips of the medullary rays. Some of the glomeruli showed an increased number of nuclei, while the capsules showed proliferation of the connective tissue. The tubules, in the areas of marked connective tissue increase, were much contracted. In the cortex, some of the tubules contained hyaline casts, with adherent leucocytes, a few contained masses of leucocytes. Some arched and straight collecting tubules contained masses of red cells and brownish pigment. Diagnosis, chronic interstitial nephritis (with hemorrhage into collecting tubules).

In connection with this case Dr. Pool said that much had been written in recent years about a certain unusual type of renal hæmaturia, and that while some writers had claimed that a so-called essential hæmaturia might occur without any demonstrable lesion, the prevailing opinion appeared to be that there was always a lesion to account for the hemorrhage. If this is true, the term

limited to the pyramid, and that in time it would have developed into a cyst of large size, occupying a great part of the kidney. I believe, however, that its full size was attained as the wall was quite thick and well developed. The most probable explanation of its limitation seems to be that it was a slowly developing cyst with an inflammatory reaction surrounding it which developed with greater rapidity than the cyst, thereby restricting its growth. The most striking observation in the case was the lesion of the papilla, which presented a dense sclerosis with incrustation of calcium phosphate, and which served as the cause of the cyst formation. The cause cannot be definitely determined as to whether the primary focus was a calcium infarct with a gradual deposition of salts and a secondary sclerosis or a primary necrosis with sclerosis and secondary calcification. It is most probable that it was the latter. It is extremely interesting that the process was confined to one papilla and that the others were, as far as could be determined, in a normal state of preservation.

Very little is written concerning inflammatory lesions of the renal papillæ with the exception of those following tubercular process, the varicosities described by Pilcher and Cabot cannot be included in this category. Papillitis and papillary sclerosis are not mentioned in the ordinary text books, and in a very careful survey of the literature I am able to find but few references to it. Virchow and Rayer speak of pyleo-papillitis fibrosa and consider the process the cause of kidney cysts. Kaufmann speaks of desquamative papillary catarrh which he found in association with uric acid and calcium infarcts and following the ingestion of certain poisons. Levaditi was able to produce a necrosis and secondary sclerosis of the papilla followed by incrustation of salts with vinylamin; and it has been found that certain drugs such as glycerine, iodoform, aloin, and formalin occasionally cause necrosis and sclerotic changes in the papillæ. It is to be noted that these descriptions are findings of research investigations and not clinical observations. The author has not been able to find any mention of the lesion in the perusal of the surgical litera-



Dr L. Jaches, which showed a large stone in the pelvis of the right kidney. On April 23, Dr Lilienthal catheterized the ureters, passing easily into the left normal ureteral orifice and withdrawing clear urine. On the right side, the catheter was arrested at one and a half cm, and drew no urine. The mucosa around the right ureteral orifice was injected and œdematous. The urine from the left kidney showed nothing abnormal.

On April 24 the usual transverse incision was made over the right kidney, and after resection of the twelfth rib the kidney was delivered, but not without considerable trouble, owing to dense adhesions around the pelvis of the organ. A nephrectomy was at once performed, and the vascular pedicle ligated with silk, the adhesions preventing the isolation of the individual vessels.

The specimen, on section, showed marked fatty degeneration, and a single, large rough calculus in the much dilated pelvis. The ureter was the size of an adult thumb, and its walls were greatly thickened. Believing that the thickening and dilatation were due to stricture at its vesical termination, Dr Lilienthal removed the entire ureter by the method he had described in the *ANNALS OF SURGERY*, April, 1911. Both wounds were drained and healing was prompt, excepting at the site of the silk ligature surrounding the pedicle, which still protruded from the wound in the loin at the time of the patient's discharge, about five weeks after the operation.

Barring a tendency to alkalinity of the urine, which was kept in check with the help of urotropin and benzoic acid, this patient now enjoyed good health.

#### TUBERCULOSIS OF THE KIDNEY AND URETER NEPHRO-URETERECTOMY

DR EUGENE H. POOL presented a woman, a trained nurse, twenty-three years old, who for four weeks prior to her admission to the hospital was troubled with frequent painful attacks of hæmaturia. Three years ago and at intervals since then she had had similar attacks. Otherwise, she had always been well and strong.

A cystoscopic examination, made by Dr Benjamin S. Baringer, showed a much congested bladder wall, with ulcerated areas in the region of the trigone. The right ureteral orifice was apparently normal, the left was surrounded and overhung by

seem to belong to the class of retention cysts following obstruction.

*Etiology*—The etiology is obscure in most cases as can be observed from the study of the literature. Serous cysts are quite infrequent. In 2610 autopsies at the Middlesex Hospital, Morris met with but 5 cases. Israel found but one in 297 surgical affections of the kidney. Simon in 1906 collected 52 cases. The malady is one of adult life. Simon's report reveals but 7 under twenty years of age. Wagner's case, four years of age, is one of the youngest, and the case of Fox, seventy years of age, is one of the oldest. Males and females seem about equally liable to the disease. Albarran reports a slight advantage to the male, whereas Tuffier gives a proportion of 20 to 3 in favor of the female. Fowler reports 22 females and 12 males. Newman's 2 cases were both males. The right kidney seems to have been more commonly affected. Fowler gives a proportion of 22 to 10 in favor of the right. There seems to be no definite association with any particular disease, though many have reported such diseases as pneumonia, typhoid fever, dysentery, gall-stones and gout as precursors. Pousson says that any disease which is liable to produce nephritis may lend a hand to the production of kidney cysts. Certain drugs and poisons have been thought to be of etiological moment. Among them are corrosive sublimate, phosphorus, glycerine, aloin, vinylamin, etc. The method of cyst production is thought to be due either to a papillary necrosis with secondary incrustation with salts, as in the experiments with vinylamin, or to an infarct process with consequent papillitis, retrodilatation and cyst formation. The experimental work which has been undertaken with a view of producing cysts has been of two classes—the first being an attempt to produce an obstruction to the outflow from the tubules by various mechanical methods directed to their exit—the papilla, the second consisting in the administration of certain chemicals which seem to possess a selective action upon this particular location. Of the first type of experiments, those of Pettersson and Tollens are the most significant. Pettersson, after

this method of extirpating the ureter before the profession, but for some unknown reason surgeons seemed to be content with taking out the kidney and leaving the tuberculous ureter, perhaps filling it with carbolic acid and if necessary removing it at a subsequent operation. It has been demonstrated that in tuberculosis of the kidney the vesical end of the ureter was apt to be diseased or likely to become so. By the method he had described the ureter could be removed in a very few minutes—perhaps ten or fifteen—and the patient was then freed, once and for all, of the entire tuberculous focus.

DR CHARLES N DOWD said he had resorted to this procedure, as described by Dr Lihenthal, and had found it very simple and easy, and very much more satisfactory than the removal of the ureter at a secondary operation.

DR POOL said that in addition to the fact that the removal of the ureter in such a case was a very rapid and easy procedure, it should be emphasized that this only held good at the time of the primary nephrectomy. In a secondary nephrectomy it was apt to be very difficult to expose and free the upper part of the ureter, therefore the method was scarcely applicable to such cases.

#### HABITUAL FORWARD DISLOCATION OF THE HEAD OF THE ULNA

DR WILLIAM DARRACH presented a man, twenty-one years old, a chauffeur, who had come to Roosevelt Hospital two days ago with the following history. Eleven months before he had received a back-kick while cranking an automobile, the crank-handle remaining in his hand. This injury, as shown by the X-ray, produced a fracture of the radius one inch above the articular margin, together with a fracture of the ulnar styloid. Three and a half weeks later he returned to work with a strong and useful wrist. Twelve weeks later the radius was refractured at the same point from a similar cause. Attempts at reduction at this time were less successful, the lower fragment maintaining its dorsal displacement. X-rays taken before and after these attempts, however, showed an abnormal mobility of the head of the ulna. Massage was begun on the fourteenth day, and after three and a half weeks he was able to use the wrist without any apparent impairment of function.

Six months after the second injury the patient was thrown

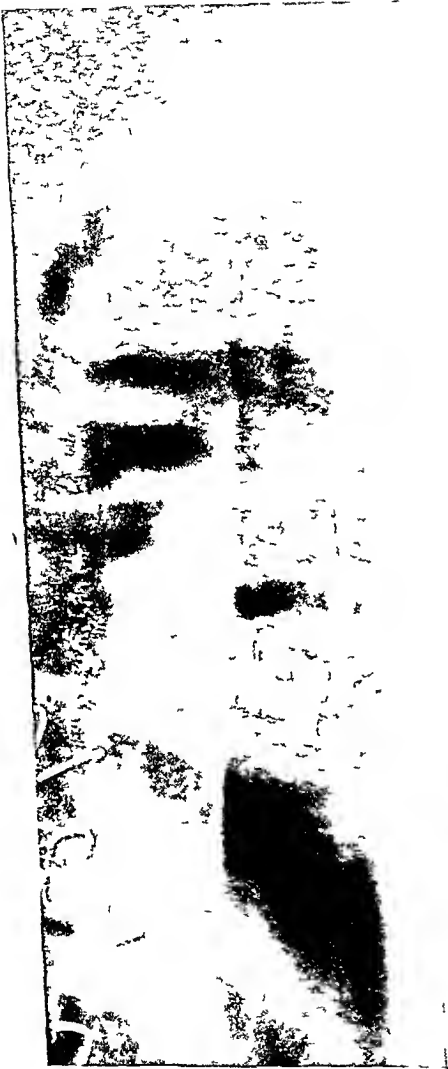
*Symptoms*—In surveying the symptoms referable to kidney cysts, one is impressed with their great variability. Cysts, when small, generally pass unrecognized during life and are usually post-mortem findings. If large, the symptoms depend upon the size, location, the pressure effects, the presence of infection and hemorrhage.

Pain is very fickle. In the cases examined, it was present in about 60 per cent. When present, it ranged from a dull ache to an acute colic, the former being the predominant type. It is generally located in the loin or hypochondrium. Radiation has been very infrequent. Hæmaturia rare. Lipskeroff's case, which was diagnosed ruptured kidney, was accompanied by profuse bleeding. Jower's case mentioned by Fowler was associated with hæmaturia. Increased frequency of urination has been described only in a few cases. Painful urination, rare. It was present in Hartman's case. The urine is generally normal in amount. Cysts of large size produce various pressure-effects, causing disorders of the gastro-intestinal tract, sensations of weight from the tumor, dyspnoea, weakness and emaciation.

*Diagnosis*—The diagnosis has seldom been made, even in cysts of large size. Among the diagnoses which have been made are floating kidney (and it should be mentioned that the association of cysts with floating kidney has been observed in a number of instances), hydronephrosis, solid renal tumors, ovarian, splenic, hepatic, omental, pancreatic and mesenteric cysts, and ascites. The urinary findings have in most cases been negative. The cystoscopic ureter catheter and functional tests have usually failed in differentiating the lesion. X-ray has been of little service. However, Wulff diagnosed a solitary cyst of the kidney with the X-ray and had it confirmed at operation. The tumor, if large, is usually rounded, smooth, dull on percussion, at times fluctuant. The diagnosis of its renal origin depends upon the classical differentiation of renal tumors from other abdominal tumors, hence, it will not be described.

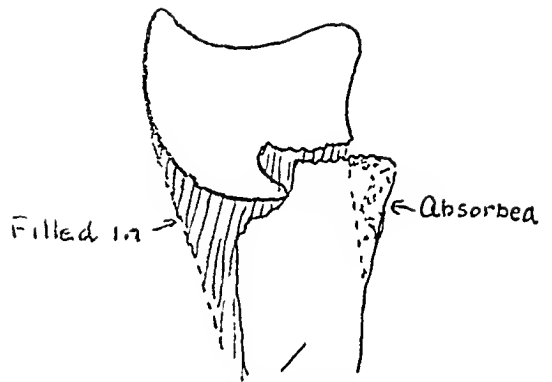
*Pathology*—Serous cysts may be single or multiple, gen-

FIG 3



After 'reduction'

FIG 4



Showing the way nature has tended to obliterate the deformity

and, at times, is calcareous. It is composed of dense fibrous tissue, scarce in cells (Le Dentu). In certain cases it is composed of stratified layers, more or less adherent (Lamar). Lejars and Sibilleau, in their cases, describe the cyst wall as being composed of a thick superficial reticulated wall, and a deep wall formed by pushed-up parenchyma in which one sees thrombosed veins. The cavity is divided incompletely by thickened bands which have the appearance of heart columns. Terrier has noted in the external coat, canals of different diameters, capillaries full of blood, arteries with endarteritis, and renal tubules. Hyaline changes have been frequently observed in the cyst wall. Smooth muscle and nerves have also been noticed. Concerning the lining of the cyst cavity, there have been great differences of opinion. Terrier says that wall is composed of fibrous tissue destitute of all epithelial lining, even in the depths of the wrinkles. According to Follin and Duplay, the wall is formed of a layer of connective tissue whose internal surface is smooth and serous in aspect, and is never covered with epithelium. Lejars has observed many plate cells, Leveran many thinned-out tubule cells, and Cornil and Babinski many pavement and cuboidal cells. Delkeskamp has seen cuboidal cells lining the cyst. Bonneau and Hartmann report a cyst lined with flat cells containing elongated nuclei, reminding them of endothelium. In certain places it seemed more like nucleated protoplasmic plaques than distinct cells. The lining was not continuous. On the contrary, Le'cene' has seen the interior of the cysts lined continuously with cuboidal cells. Papin has also observed flat and cuboidal epithelium. Simon says the epithelium is not constant but exists in the majority of cases.

The parenchyma near the cysts has shown various changes. Terrier remarks that to the naked eye the renal tissue looks normal but microscopically there are evidences of nephritis. The parenchyma is thickened next to the cyst wall, the juxtacystic tissue is inflammatory, and the walls of certain tubules show a slight degree of fatty infiltration. The kidney away from the cyst is normal (Delkeskamp). According to



removed, edges of the wall stitched to the abdominal parietes, cavity drained and allowed to contract. In some cases complete obliteration ensues.

The advantage of such methods are that they do not interfere with the remaining kidney tissue and are not accompanied by hemorrhage. The disadvantages, which have the predominance, are that the wound is slow in healing, is always liable to secondary infection, and the danger of fistula is great. Morris reports five cystotomies with three fistulae. Simon reports three cystotomies, one cure, two deaths. Tuffier's statistics show eight cystotomies, six transperitoneal and two lumbar, three were followed by fistula and one required nephrectomy later.

For cysts of moderate size, the most satisfactory method is the one which has been utilized by Tuffier, Bardenheuer, Ricard, Recamier and Albarran, each in one case—namely, the excision of the cyst. In this manner most of the renal substance is preserved and the function of the kidney but little interfered with. In the description of their cases it is noted, as one would suppose, that the cysts would not shell but required dissection. Concerning this point, the cyst removed by the author differed, as it shelled out easily, required no cutting at all except in the region of the papilla, where it was cauterized from its attachment to the pelvis. Bardenheuer had to do a secondary nephrectomy on account of infection. Hemorrhage did not prove alarming in these cases, and it should be no more copious than that following an ordinary nephrotomy, provided one closes the kidney properly, following the removal of the cyst.

Partial nephrectomy, according to Morris, should be performed if the cyst is situated at one pole of the kidney and a considerable part of the renal parenchyma is spread out over the cyst wall, and if the large renal vessels can be left intact. This operation has held but little prestige and is seldom used.

Complete nephrectomy is applicable to very large cysts, which have destroyed most of the renal substance, and to



by Stimson,<sup>4</sup> Holst,<sup>5</sup> and Leuven,<sup>6</sup> making 33 in all. Those associated with fracture of the radius are far more common, but are very apt to be overlooked. The dislocation is usually reduced with the fracture, and generally heals with it. Occasionally, however, the ulnar head remains out of place, and this is often recognized only after the swelling has gone down and the splints removed, as in the case shown at a meeting of the New York Surgical Society last May.<sup>7</sup> In another group, the main lesion is not the lack of reduction, but the tendency toward imperfect repair of the structures on which the strength of the joint depends, namely, the triangular ligament and the joint capsule. The former, with its attachments to the sigmoid cavity of the radius and the base of the ulnar styloid, is the most important, and when this is torn across, or when the styloid is torn away from the ulna close to its base, the ulnar head loses its stability and a lax joint results. This laxity may be only an abnormal mobility of the ulnar head which interferes but slightly, if at all, with the function of the wrist, or it may be sufficient, as in this case, to allow the head to slip out of the sigmoid cavity. Habitual dislocation at this joint seems to have received scant attention, and with the exception of three cases reported by Hoffa,<sup>8</sup> and three by Courtin,<sup>9</sup> the speaker said he had found nothing beyond mere reference to its possibility. The impairment of function in this case was not sufficient to warrant immediate operative measures, and the use of a leather wristlet had been advised for a period of some months. If he then found sufficient disability, a resection of the lower inch of the ulna would seem the best procedure. In order to actually repair the damage it would be necessary not only to obtain union between the ulnar head and styloid and reef the capsule, but also to overcome the backward bending of the radius, with its resulting strain on the front part of this joint.

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<sup>4</sup>Stimson N Y Med Jour, May 25, 1889

<sup>5</sup>Holst Centr f Chir, 1891, No 25, p 496

<sup>6</sup>Leuven Centr f Chir, 1906, No 42, p 1128

<sup>7</sup>Darrach ANN OF SURG, November, 1912, lvi, p 801

<sup>8</sup>Hoffa Verhandl der Deutsch Gesellsch f Chir, 1898, Pt 1, p 156

<sup>9</sup>Courtin Gaz hebdomadaire de Sc Med de Bordeaux, October 8, 1905, p 481

finned to the pyramid, there being no cortical substance composing its wall or immediately adjacent to it. The wall of the cyst was firm and dense, containing no remnants of tubules as far as could be determined, nor did it possess any epithelial or endothelial lining. This latter point has been argued by some as refuting the tubular origin of cysts, but it seems without sufficient ground, as one would scarcely expect an epithelial lining to be preserved in a cyst having such thick sclerotic walls with poor nourishment. There has undoubtedly been an epithelial degeneration. In the kidney adjacent to the wall one can trace various gradations of epithelium from tubular to flat, depending upon the size of the cyst space. There was but one large space found in the sections examined which possessed a cubical epithelial lining. This is illustrated in Figs 5 and 6. The renal cortex, corresponding to the area drained by the diseased papilla, was not thinned out. On the contrary, it was slightly thicker than the remaining cortex, was quite dense and sclerotic, but contained no visible cysts.

The operative features of interest are that the method employed has been utilized, as far as can be determined, but five times previously—by Tuffier, Bardenheuer, Ricard, Recamier and Albarran, and that no trouble was experienced in shelling the cyst from its bed, as it was completely demarcated from the remaining kidney.

Finally, the author wishes to express his sincere thanks to Professor Opie for suggestions in the pathological preparation of this paper, to Professor Shaffer for the analysis of the stone, and to Dr Downey L. Harris, bacteriologist of the city of St. Louis, for his excellent microphotographs.

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of the appendix, and became more scattered as one left that region. The loops of the ileum were drawn down into the wound, and showed a few tubercles, and there were more upon the visceral than upon the parietal peritoneum. The serous surfaces were moist, but there was no fluid. There were no adhesions. The appendix itself lay below the caput, towards the pelvic brim, it was but moderately congested, and showed only a moderate number of tubercles on its surface. The presence of so many tubercles in the mesentery was thought to indicate a possible lesion of the mucosa, peritoneal invasion being most marked near the seat of origin.

The appendix, on removal, showed but moderate thickening of its coats. The internal calibre was even throughout, and there were no constrictions. It was empty. There were several small hemorrhagic spots in the mucosa, but no ulcerations. Microscopic examination showed that the tubercles were confined to the peritoneal coat.

The interesting features of this case, Dr Schley said, were the previous pulmonary lesion, the apparent excellent health of the boy, notwithstanding the fairly extensive peritoneal involvement, the close simulation of his attacks to recurrent appendicitis, and his apparent entire restoration to health after the removal of the appendix and the involved mesentery and a year's sojourn in the country, where he would continue to reside indefinitely.

#### TUBERCULOUS PERITONITIS FROM INFECTED ADNEXA

DR W S SCHLEY showed two patients, the first case was that of a mulattress, twenty-three years of age, a laundress by occupation, who entered the hospital on December 23, 1912. Her chief complaint was pain low down in the right abdomen, which became so acute six days before her admission that she had to give up her work. Three years ago she had had a similar attack, which disabled her for a few days, but during the interval, with the exception of constipation, she had enjoyed fairly good health. She had begun to menstruate at the age of sixteen and had always been regular. There was no history of previous pelvic trouble, no pregnancies. The patient was a well-nourished woman, and did not appear to be acutely ill. An examination of the chest was negative. The abdomen was soft, and no masses could be felt. There was slight tenderness low down on the right

ually undergo cicatrization. Such scars naturally retract, and the original extensive lesion is reduced to a comparatively insignificant affair. However, much of the kidney parenchyma is destroyed by this process, and, while the compensatory hypertrophy may restore the initial volume of the kidney, much actual parenchyma is lost. The occasional finding of bone in these old scars is only of theoretical value. Inasmuch as the essential damage done by suture and by incision consists in the interference with the blood supply, it might be well to discuss the blood-vessels of the kidney before proceeding with a description of any technic.

*The Renal Blood-vessels*—The kidney is plentifully supplied with blood by the renal artery, a large offset of the abdominal aorta. Previous to entering the kidney, each artery divides into four or five branches, which are distributed to its substance. At the hilum these branches lie between the renal vein and ureter, the vein being in front, the ureter behind. Each vessel gives off a small branch to the suprarenal capsules, the ureter, and the surrounding cellular tissue and muscles. It has been pointed out by Hyrtl (p. 679) that the renal artery gives off a branch which divides and supplies the dorsal portion of the kidney and a branch which divides and supplies the ventral portion of the kidney. Between these two vascular systems is a non-vascular zone, called by Bryon Robinson the "exsanguinated renal zone of Hyrtl." It "is one-half inch dorsal to the lateral longitudinal renal border."<sup>1</sup>

This anatomical condition has been taken advantage of by Dr. E. K. Cullen, of Baltimore (*Surgery, Gynecology and Obstetrics*, vol. xiii, p. 365), in devising a method for opening the kidney. Dr. Cullen has established rules for locating the bloodless zone in the kidney, and advocates the use of a silver wire that tears its way through the kidney parenchyma. This procedure, theoretically beautiful, has not met with the good results in our hands that have been described. The objections

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<sup>1</sup> From Gray's Anatomy, Da Costa, p. 1423, 1905

verted and fixed, with induration and a sense of a mass high up on either side. On opening the abdomen, the intestines were found to be matted together and to the abdominal wall, the condition being similar to that described in the previous case, excepting that in this case the adhesions were more dense and there were more numerous vascularized bands. It was practically impossible to reach the uterus or the right tube, which was felt to be hard and enlarged by an examination with one hand in the vagina and the other in the abdomen. The adhesions were so dense that attempted separation involved the peritoneal coat to a dangerous extent, with the imminent danger of causing a perforation. The tubes apparently lay matted to the intestinal coils and not in the cul-de-sac. Macroscopically, there were no tubercles.

The interesting features of these cases were the apparent good health of the patients, and, in the cases of the two women, the absence of more severe pelvic and intestinal symptoms. The constipation was only moderate; the nutrition was good and had improved during the past few months, notwithstanding a matting of the gut so great and extensive as to render it apparently almost immobile. This feature of the nutrition had been noted by others in similar cases. The condition in the women was undoubtedly in the so-called terminal or curative stage, there being every evidence that they had, at least temporarily, overcome their infection. Whether called a chronic fibroid tuberculosis or a fibro-adhesive tubercular peritonitis, the tubercles were largely replaced by connective tissue. The cases were probably never of the ascitic variety. In both of these cases the disease process had been of some duration, but they had only applied for relief when the contractions and distortions of the newly-formed tissue caused pain, and not because of any toxæmia or interference with health from the tuberculosis, notwithstanding the fact that the focal infection in the tubes had not been removed. In these cases it was impossible to palpate or examine the liver or spleen or peritoneal glands with any degree of accuracy. About 68 per cent of these cases, Dr. Schley said, were of the exudative type, 27 per cent of the fibro-adhesive type and but 4 per cent of the suppurative. Post-mortem figures gave a slightly greater preponderance to the occurrence of this condition in males, and the operative figures to the female. This discrepancy might be explained from a symptomatic standpoint, as even the milder

FIG 1



Contracted kidneys Pelvis full of calcium phosphate stones  
 tion of strangulated kidney substance—one of the danger (t 1 2) u (t) ca uhca-  
 h t u u

FIG 2



Kidney split with silver wire in bloodless zone—shows variability in size of infarcts (Three days)

headache, the pain was usually in the occipital region and extended to the back of the neck. It was always worse at night. For the past ten years she had been troubled with insomnia, and suffered much from a dull, aching pain in the small of the back, this had been almost constant, but had varied in severity. She felt as if her back was "in a strained position," and had a sensation of weight or heaviness in the abdomen. At times there were shooting pains throughout the abdomen, at other times she had pain in the left hypochondrium. She had long suffered from shortness of breath on slight exertion, her limbs felt tired and had ached as though her "bones were sore."

Upon inspection, the patient showed evidence of rather severe anæmia. There was pigmentation of the forehead, sides of the nose and cheeks and the chin. The conjunctivæ presented, in a measure, the wedge-shaped thickening referred to by Brill. Examination of the abdomen showed that practically the entire left side was occupied by a smooth, fairly movable tumor which was without doubt the spleen, extending to within three inches of the umbilicus and well down into the pelvis. The liver was palpable below the margin of the ribs, but was not much enlarged. There was no free fluid in the abdomen. The superficial lymph nodes were not palpable. No pain nor tenderness was elicited by pressure over the long bones. Except for a moderate retroversion, an examination of the pelvic contents was negative.

The patient's weight, when she came under Dr. Downes's observation, was 113 pounds. An examination of the blood for the malarial organisms was negative, as were also the Widal and Wassermann tests. On October 4, 1912, a blood examination showed 3,840,000 red cells, 1400 white cells, 60 per cent of polymorphonuclears, 40 per cent of mononuclears and 49 per cent of hæmoglobin. The urine contained a trace of albumin. A radiograph of the abdomen was negative. The patient was put on iron and arsenic, and during the next three weeks she gained four pounds in weight and the hæmoglobin increased to 57 per cent. However, the leucopenia became more marked, the count showing as low as 900 white cells per cm. on October 28. Under forced feeding and increasing doses of iron and arsenic, the blood picture showed some improvement, the hæmoglobin increasing to 65 per cent, while the count had not changed materially.

FIG 1



Contracted kidneys Pelvis full of calcium phosphate stores due to calcification of strangulated kidney substance—one of the dangers of

FIG 2



Kidney split with silver wire in bloodless zone—shows variability in size of infarcts (Three days)



was reddish-gray, which on closer examination was seen to be due to innumerable pin-point gray points, separated by a small amount of dark red substance. Here and there were seen scattered circular, dark red spots, of about 1 mm diameter, which were distinctly raised above the surface. The trabeculæ were almost indistinguishable, and there was no evident increase of connective tissue about the main vessels. Microscopic sections showed the condition which had been previously described as a primary epithelioma, and more recently by Bovaird, as a primary endothelioma.

DR JOHN F ERDMANN showed a spleen which he removed about a year ago from a child then three years and three months old. The case was one of primary splenomegaly of the Gaucher type. The child at this time was in very poor condition, it weighed 27 pounds and gave a recent history of double middle ear trouble and bronchitis. Dr Erdmann said that in this case he was able to remove the spleen without much difficulty, excepting that he had found it necessary to include about an inch of the pancreas. The weight of the spleen was about one-twentieth of the weight of the child. The child was discharged from the hospital on the eighteenth day, and since the operation, which was done about a year ago, it had remained in good health, had gained weight and shown improvement generally, including the condition of the blood.

Dr Erdmann said he thought this type of splenomegaly was a family disease, as there were a number of cases on record where it affected several children in the same family. In the case he had reported, it was the second case in that particular family.

DR F S MANDLEBAUM (by invitation) said that of the five operated cases thus far on record, there were two deaths, which was a mortality of 40 per cent. The case shown by Dr. Downes and the one now reported by Dr Erdmann would lower this rate materially. The speaker said that about two months ago, when he last reviewed the literature of the subject, he had found only ten authentic cases on record, to which he had added the eleventh. A number of cases of so-called Gaucher splenomegaly had recently been described, but apparently they did not prove to be of that type. The disease was a very rare one, and as Dr Erdmann just mentioned, it often affected several members of the same family. As a rule, the females were affected rather than the males, only



upon opening the abdomen it was found that the man had a syphilitic liver and that the splenic enlargement was also secondary to syphilis. The man made a good recovery. The spleen in this case weighed about 1700 grams, and gave the patient a great deal of discomfort because of its size.

### UNUNITED FRACTURE OF THE HUMERUS

DR DOWNES presented a woman, fifty-seven years old, who was admitted to the New York Hospital on September 27, 1912, with the history of having fractured her left humerus six months before, non-union resulting. The X-ray showed an extremely oblique fracture, involving six inches of the shaft of the bone and extending to within one inch of the head.

An open operation was done on October 3, 1912. Dr. Downes said it was his intention to introduce a bone graft, but upon exposure it was seen that the extreme obliquity of the fracture had practically destroyed the lumen of the bone, and it was out of the question to attempt to introduce an intramedullary support of any kind. About two inches of the end of the proximal fragment was thereupon removed and the fractured surfaces of each fragment freshened with the curette. An aluminum bronze wire suture was then passed through a drill-hole and around the shaft just at the point where the tip of the upper fragment joined the lower, similarly, a heavy kangaroo tendon was passed above at the junction of the tip of the lower fragment with the upper. The wound was then closed without drainage, and a plaster case was applied.

The woman being very stout, the case became irksome, and at the end of one week she complained that she could not stand it any longer. It was therefore removed, and with a small pad of absorbent cotton between the arm and chest, the upper arm was bandaged directly to the body and secured in this position by wide strips of adhesive plaster encircling the chest. This dressing was left undisturbed for six weeks, when it was renewed, the arm being kept immobilized for about three months. At this time union had taken place and was fairly firm, as shown by examination and X-ray.

This case was shown, Dr. Downes said, principally to illustrate an unusual condition of oblique fracture of the humerus, and also to emphasize the fact that complete immobilization could be easily obtained by the use of the body as a splint, a

A TABLE SHOWING CHANGES IN THE KIDNEY SUBSEQUENT TO ATRESIA OF THE RENAL VESSELS FOR VARIOUS PERIODS OF TIME

A E No	Time of atresia	Time after operation	Lesion
106	1 hour	3 days	Degenerative lesions, desquamation of epithelium, basal fat, fatty metamorphosis
109	1 hour	3 days	Exudate in tubules, basal fat and fatty casts
53	1 hour	5 days	Indeterminate
49	1 hour	6 days	No difference in kidneys
50	1 hour	6 days	No difference in kidneys
52	1 hour	3 months	No difference in kidneys
63	1 hour	3 months	No difference in kidneys, except compensatory hypertrophy on account of removal of other kidney Nitrogen output normal
12-105	2 hours	3 days	Fatty metamorphosis, basal fat, degeneration and desquamation
12-110	2 hours	6 days	Many casts Spontaneous nephritis
12-70	2 hours	6 days	Basal fat, exudate in tubules, degeneration of tubules
12-80	2 hours	34 days	Small infarct
12-68	2 hours	90 days	Normal
12-69	2 hours	90 days	Normal Compensatory hypertrophy from removal of other kidney Nitrogen output normal

In the one-hour series there was usually found after a convalescence of three days degenerative lesions, involving the epithelium only, desquamation of epithelium of tubules, and more or less fatty change, sometimes basal fat. As the accompanying table will show, animals that were killed six days after the atresia did not manifest these lesions. Therefore the damage must be quickly repaired. In the two-hour series the fat changes were much more marked than in the one-hour series, and the degenerative changes more prominent. These changes were also transitory, but of slightly longer duration.

As no changes were found in either the one-hour series or the two-hour series in animals killed after a longer interval of time, it was assumed that the slight degenerative lesions and fat metamorphosis were quickly recovered from, probably by a process of epithelial desquamation and regeneration. That a kidney can functionate after one-hour atresia to sufficiently maintain life is shown in A E 12-63, and often after two hours' atresia in A E 12-69.

tained as long as the man remained in the hospital, and kept his leg in a fairly elevated position. The operation was done about a year ago, and Dr Erdmann said he had since heard from the man's physician that the improvement in the œdema had disappeared after the man left the hospital and had neglected himself.

DR LYLE said that in cases of filariasis attempts had been made to reduce the œdema by setting up a collateral circulation between the lymphatics and the bone cavity by implanting into it the fascia lata, in the hope that the bone circulation would carry off the excessive lymph. Dr Lyle thought that this was a much more rational procedure than the string method.

DR ARTHUR L. FISK said he thought a certain amount of caution should be exercised before resorting to this method, as in many of these cases a collateral circulation was eventually re-established. We knew that in milk-leg and phlebitis there was manifest œdema which might persist for some time, but which eventually disappeared.

DR SYMS, in closing, said the immediate result of the Handley operation was usually very promising, the swelling often disappearing rapidly, but the end results were apt to be disappointing.

Cases have been reported where the cure has been apparently permanent, but we should not lose sight of the fact to which Dr Fisk called attention that some of these cases were such as might improve or get well without operative interference.

The speaker said that the method seemed to be promising in cases of ascites. However the method should be given further trial, for more evidence is needed before we can form conclusions.

#### RÖNTGEN RAY PLATES DEMONSTRATING RE-ESTABLISHMENT OF COMMUNICATION BETWEEN THE STOMACH AND THE DUODENUM AFTER PYLORECTOMY

DR A. V. MOSCHCOWITZ said that at the preceding meeting of the Society, Dr George E. Brewer had presented a series of cases of duodenal ulcer which gave rise to considerable discussion as to the necessity of occluding the pylorus when making a gastrojejunostomy for the cure of the ulcer. In discussing this point, Dr Moschcowitz said he had pointed out that it was not an easy matter to occlude the pylorus, and a case which they had under observation at that time at the Mt. Sinai Hospital had prompted him to make the statement that even pylorectomy was not absolutely certain to produce pyloric occlusion. This

*Résumé* —Mattress sutures cause extensive destruction of kidney substance

Silver wire with mattress sutures cause a variable amount of damage.

Simple incision with over-and-over sutures does not produce serious lesions

The serrefine method produces slight lesions While this is not free from infarction, the only legacy left is a slight loss of parenchyma without other complication

I am indebted to Dr E T Bell for his method of staining fat

Based on the above report by Dr Jaches, the speaker said he had made the statement at the last meeting that even pylorectomy was not absolutely certain to produce pyloric occlusion. In order to verify this, he had again sent for the patient and had again had him flouroscooped, and also had plates made. Dr Jaches reported as follows: On January 27, 1913, this patient was submitted to another X-ray examination, because at the examination made ten days previously the main reliance was placed on the flouroscope, and the few plates which were taken did not show the passage of the bismuth-zoolak through the pylorus. At the second flouroscopic examination, the passage was again noticed, it did not show up as clearly as the first time, but a number of plates were taken and most of these showed the passage of the bismuth. Plate 1, which was taken about half an hour after the ingestion of the bismuth, showed the food passing through the stoma, and a considerable quantity already in the coils of the small intestine, and it also showed some bismuth in the duodenum (probably the second portion), also passing downwards. Plate 2 and plate 3, taken a few minutes later, showed practically the same conditions. Plate 4, taken one hour before, again showed the bismuth in part of the duodenum. Plate 5, taken an hour and three-quarters after the ingestion of the meal, again showed bismuth passing through the pylorus.

Dr Moschcowitz said he had not had the time to look up the literature on the subject, but he had a distinct recollection of having read of similar occurrences in experiments on animals. At the last meeting, Dr Charles A. Elsberg had related similar personal experiences with animals.

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*Stated Meeting, held at the New York Academy of Medicine,  
February 26, 1913*

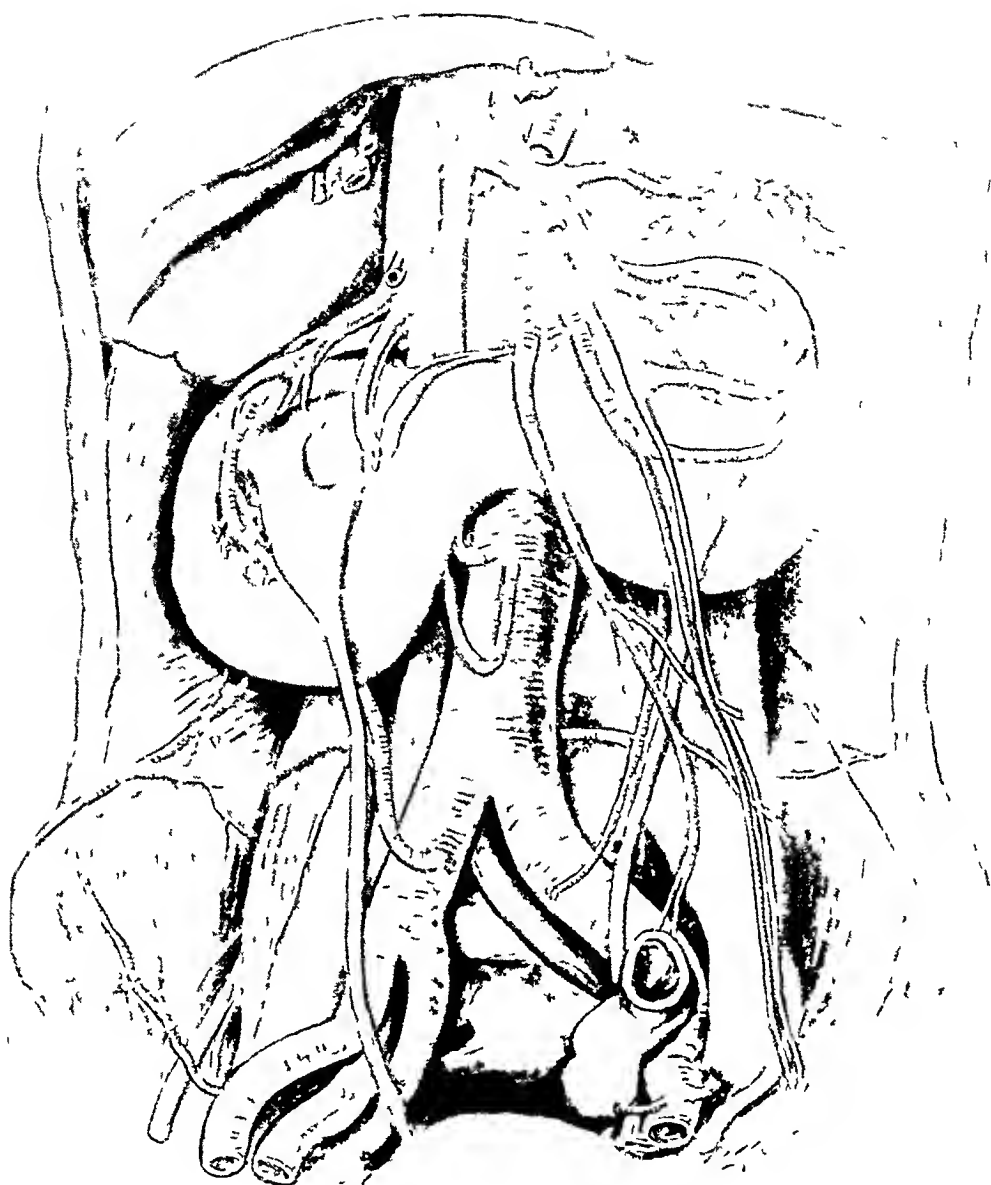
The President, DR CHARLES L. GIBSON, in the Chair

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#### PERFORATING DUODENAL ULCER

DR NATHAN W. GREEN presented a man, thirty-seven years old, who gave a history of intermittent gastric trouble dating back for three or four months. When he was admitted to St Luke's Hospital, on November 11, 1912, he complained of pain

FIG 1



Dumb-bell kidney



tion He saw no reason why a gastro-enterostomy should not be done at once, if the condition of the patient warranted the prolonged operation, and these cases are usually in good condition if they come under observation within a few hours after the perforation occurs

DR CHARLES L. GIBSON said that personally he had never done a gastro-enterostomy in a case of perforating gastric or duodenal ulcer, and he had never had occasion to regret it He thought it should only be done in exceptional cases, where there was evident obstruction In one case which he operated on recently he found two acute perforating ulcers of the duodenum, which he closed by infolding them with a purse-string suture, although this procedure caused a slight stenosis of the pylorus he did not do a gastro-enterostomy. In that case, although the patient made a good recovery, a subsequent gastro-enterostomy might become necessary, but personally he was rather inclined to resist the present-day tendency to do a gastro-enterostomy in these cases as a routine procedure

#### SEPTIC SECONDARY HEMORRHAGES SUBSEQUENT TO AMPUTATION OF THE BREAST FOR CARCINOMA.

DR ALEXIS V. MOSCHCOWITZ presented a woman, thirty-eight years old, who was admitted to Mt Sinai Hospital, in the service of Dr Gerster, on November 11, 1912, suffering from a tumor of the left breast. She had first noticed this growth about two months before, and during that period it had increased very rapidly in size The salient points of the physical examination of the patient were that practically the entire left breast was involved, that the tumor was very hard, and that there were massive glands in the corresponding axilla A notable feature of the case was that though the integument covering the breast was very much thinned, the result of stretching, it was not adherent and evidently not involved

On November 13 a typical amputation of the breast and axillary contents was done, together with extirpation of both pectoral muscles The operation was exceedingly easy, and including the suturing and dressing, consumed less than fifty minutes In connection with the operation it was of importance to note that in spite of the very extensive removal of the skin,

explained through an error in the first diagnosis (appendicitis), it may be said that the patient who was operated on for appendicitis three years before Dr. Frazier operated for duodenal ulcer, had a gangrenous appendix, and that his wound had to be drained.

DR JOHN H JOPSON noticed that no attention had been paid to the size of the perforation and the relationship to symptoms, stating that of the four cases he had sutured, the first case was operated on under a positive diagnosis of appendicitis after more than 24 hours, the second, under a probable diagnosis of appendicitis after 24 hours, the third, with a diagnosis of perforated ulcer, after 8 hours, and the fourth, with the same diagnosis, nearly 24 hours after perforation. All the cases recovered except the last. With a small perforation the gradual leakage of fluid even under careful observation may very often lead to a diagnosis of appendicitis, especially if the previous history is lacking, and in the first two cases the perforations were of this type. He did not perform a primary gastro-enterostomy in any of these cases. In one he did a posterior gastro-enterostomy two years later. As to the occurrence of perforation of gastric and duodenal ulcers, after removal of the appendix, it leads one to suspect not always a direct causal relationship between appendicitis and gastric ulcer, but that the diagnosis in the first instance was erroneous.

DR JOHN B ROBERTS called attention to a class of perforating duodenal and gastric ulcers subsequent to operations on the intestines. He had lost two cases of bladder wound from such perforations, of the stomach in one case, from perforation of the duodenum in the other. There were quite a good many cases on record where duodenal and gastric ulcers have occurred secondary to intestinal operations.

DR G G ROSS reported one case in which the performance of gastro-enterostomy might have saved the patient's life. The man gave a history of dyspepsia and the diagnosis was peptic ulcer. He perforated at 11 A M and was operated on before 2 P M. He had a large perforation of a duodenal ulcer and great discharge of stomach contents. He had diminution of urine for two or three days after operation with symptoms of uræmia. Exactly 7 days after the primary perforation he had a second with typical symptoms, pain, tenderness and marked rigidity, and he died. Postmortem showed a second perforation of this

an actively spurting vessel in the fourth intercostal space (perforating artery), about half an inch external to the border of the sternum. This was caught with forceps and ligated.

On the following day the patient was removed to the outdoor ward, which was situated on the roof, and almost miraculously her condition began to improve, her temperature dropped to normal, and no further hemorrhage occurred. By the middle of January her wound was in a condition to permit of skin grafting, and the patient was discharged, practically well, on February 18, 1913.

### TOTAL LARYNGECTOMY FOR EPITHELIOMA OF THE LARYNX

DR WILLIAM DOWNES presented a man, sixty years old, upon whom he had operated January 27, 1913, on account of epithelioma of the larynx, the symptoms of which dated back about two months. The larynx was freely movable and there was no general lymphatic involvement, but on the right side of the interior of the larynx, the place normally occupied by the ventricular band (or false vocal cord) was taken by a red, cylindrical swelling with a slight constriction near the arytenoid. Outside the arytenoid and the aryteno-epiglottic fold was an ulcerated area that bled easily. The vocal cord was not visible, as the swelling in the region of the false vocal cord extended so far inward as to shut off a view of the cord.

Total laryngectomy was performed by Dr. Downes on January 27, 1913. An incision was made from the hyoid to within a short distance of the suprasternal notch, with liberating cuts on either side just below the hyoid. The larynx was freed anteriorly, and the trachea exposed and divided at the first ring. The trachea was then brought forward through a transverse skin incision just above the sternal notch, this incision being separated from the lower end of the original incision by a bridge of tissue one inch wide. The ether, which had been given with open mask up to this time, was now administered through an intratracheal cannula with the Janeway insufflation apparatus, and the anæsthesia was at all times smooth.

The larynx was dissected from the œsophagus from below upward, and when it was found that the growth involved the

border of the left hilum The lateral branch enters the hilum near its point of origin.

The third renal (left spermatic) arises just below the preceding, passes downward and outward, crosses the renal pelvis and enters the hilum at its infero-lateral angle The left spermatic artery arises from this vessel at its mid-point

A fourth renal arises from the anterior surface of the aorta two inches above its bifurcation and, passing upward and to the right, enters the middle of the posterior surface of the right kidney at its junction with the isthmus

A fifth aortic renal arises just below the preceding vessel and runs downward for a distance of one inch, being adherent to the aortic wall It then turns at an acute angle and ascends to the margin of the right kidney at its infero-mesial aspect

A large renal artery is given from each common iliac at the mid-point of its internal surface These vessels curve around the anterior surface and are directed upward and outward The right passes behind the ureter, to which it gives two branches, and after giving origin to the right spermatic, enters the lower margin of the kidney The left gives off one ureteral branch and then enters the left kidney at the mid-point of its lower margin

*Veins*—Three veins emerge from the right hilum Two, with a communicating branch from the upper outer aspect, pass upward and inward to enter the right margin of the vena cava A third emerges from the lower internal margin of the hilum and passes upward to the anterior surface of cava, opposite the first lumbar vertebra, the others being one-half inch above this level The veins are, anterior to the arteries

The left renal veins number three, one emerging from the upper, one from the lower and a third from the lateral edge of the hilum, the latter receiving the left spermatic vein They pass upward and inward and unite in a single trunk which joins with the splenic vein to enter the cava on a level with the highest renal on the right side The portal vein is made, therefore, entirely of the superior mesenteric vein There is no abnormality of relationship of the structures entering the portal fissure The physiological importance of hepatic influence on the blood of the splenic vein is a question for consideration in the presence of this rare vascular anomaly

*Explanation*—The primitive kidney is a pelvic organ derived from a portion of the paravertebral mesoblastic tissue of the pelvic wall, the renal blastema, and from the branching subdivisions of the expanded ends of the primitive ureter, which contribute that portion of the uriniferous tubular system represented by the straight collecting tubules Each organ is formed independently, and possibly as a result of changes in the line of curvature of the caudal extremity of the spinal column, ascends until by the end of the third month of fetal

## TOTAL LARYNGECTOMY FOR CANCER OF THE LARYNX

DR FREDERICK KAMMERER presented a man now about fifty-five years old, upon whom Dr Kammerer did a total laryngectomy for intrinsic cancer of the larynx over four years ago. The patient was first presented to the Society on March 10, 1909, six months after the operation, and he had shown no evidence of a recurrence up to the present time.

At the operation, a tumor, as large as a walnut, involving mainly the left vocal cord, was found. There was no involvement of the lymphatics in the neck. A preliminary tracheotomy had to be done four weeks before the laryngectomy on account of respiratory obstruction.

Dr Kammerer also briefly mentioned two other cases of laryngectomy for extrinsic cancer upon which he had operated during the past two years. In one of these cases he removed the larynx, over five inches of the pharynx and œsophagus, and the left half of the thyroid gland. This patient had a fatal recurrence one year later. In the second case, operated on almost a year ago, where a considerable portion of the pharynx was removed and a plastic operation had been successfully done to re-establish the continuity of the digestive tract, a recurrence immediately above the tracheal opening was now present. Such cases of early recurrence after very extensive laryngectomies were rather discouraging, and, in conjunction with the case presented to-night, emphasized the well known fact of the more benign nature of those cases in which the growth originated in the interior of the larynx.

DR GIBSON said that Dr Downes's method of preventing the spread of infection by gauze packing saturated in a one per cent iodine solution and placed well down in the lower angles of the wound on either side of the trachea had impressed him very favorably, even more so than that suggested by Dr Crile, who advised a preliminary operation with this same object in view.

SARCOMA OF THE LEFT SUPERIOR MAXILLA  
EXTIRPATION

DR HOWARD LILIENTHAL presented a woman, twenty years old, who was admitted to the Mt Sinai Hospital on December 5, 1912. She had been married about fifteen months, and had a

possibility of life in the total absence of these "vital organs" In this case the liver had apparently vicariously assumed the kidney function, as a patulous umbilical vein discharged a fluid with chemical characteristics resembling urine That the liver and intestines can assume the renal function for a time at least is undoubted, as in the case reported by Seth Gordon,<sup>5</sup> whose patient lived for twenty-seven days after the removal of a single kidney. Vieusseux,<sup>6</sup> of Geneva, reports a case of total suppression of urine without uræmia for a period of seventeen months, followed by a re-establishment of renal function and the survival of the patient

The rarity of these cases is so great that but little practical importance can be attached to them

(B) Supernumerary kidneys This condition is even more rare than is complete absence of renal tissue

Isaya<sup>7</sup> reports the case of a female aged twenty-seven, who had suffered with recurring attacks of abdominal pain since childhood Operation showed a movable tumor present in the abdomen to be a supernumerary kidney, the recurring pains being caused by twists of its ureter This author collected fifteen cases, ten of which were found post mortem, the others at operation Cobb and Giddings<sup>8</sup> found only seven cases of true supernumerary kidney in all the literature and add a case of cyst-adenoma of an accessory organ Oleson<sup>9</sup> found two adventitious kidneys in one case, one at either superior pole of a horse-shoe kidney Cheyne,<sup>10</sup> and more recently, A F Dixon,<sup>11</sup> found supernumerary kidneys at the pelvic brim These cases usually become of clinical significance as a result of undue mobility

(C) Single kidney The body may contain one mass of renal tissue as a result of (a) Congenital absence or rudimentary development of one kidney—unsymmetrical kidney, (b) atrophy of one kidney, the result of disease, (c) congenital fusion of the kidneys—solitary kidney; (d) surgical removal of one kidney

(a) Congenital absence of one kidney or extreme types of unilateral rudimentary development are rare abnormalities

the chisel the entire tumor was now removed with ease, and on examining the specimen, every portion of it appeared to have been extirpated with the exception of the inner part, adjacent to the nasal septum. Here some of the soft tissue of the tumor was seen to have been cut cleanly through by the chisel. This was dark and apparently melanotic in appearance, and was easily shelled out with the curette. The entire wound, including the left nostril, was now packed with gauze, and the ligature embracing the common carotid was loosened. This was immediately followed by severe hemorrhage from numerous vessels, so that it was deemed advisable to ligate and divide the carotid. The wound in the left side of the neck was then closed with suture, with temporary tube drainage, and the wound in the lip was sutured.

The patient made an uneventful recovery from the operation, but upon examination, on December 23, it was found that a small, hard fragment of bony tumor was still present adjacent to the nasal bone. This had since disappeared under the regular administration of Coley's mixed toxins of the bacillus erysipelas and prodigiosus.

Pathologically, the growth in this case was pronounced a spindle-celled osteo-sarcoma, especially malignant.

Dr Lilienthal said he had made use of Coley's fluid for many years, and he believed that as a result he had had fewer recurrences after operation. This was only the second case, however, where he had seen it apparently produce an absolute disappearance of what was undoubtedly a fragment of a malignant growth. In the other case which he had in mind the patient was a man who was operated on about twelve years ago for what was pronounced to be a pigmented giant-celled sarcoma of the rib. A very large section of the pleura was removed, but the extirpation was necessarily incomplete. There was an immediate recurrence in the scar, and it was not until then that the administration of Coley's fluid was begun. Its use was followed by a disappearance of the malignant growth, and the patient still remained well, now twelve years after the operation.

DR F S MANDLEBAUM said that in dealing with sarcoma of the bones, one must make a sharp distinction between the spindle-celled and the giant-celled types. The latter was not a true sarcoma, and the sooner it was taken out of the class of sar-

years, recently performed by Cullen<sup>17</sup> showed absence of the uterus, the ovaries in the inguinal canals, absence of the left kidney and a large right kidney in the pelvis simulating a neoplasm. Guiteras had the unusual experience of meeting with three cases at operation in a small hospital service within a period of ten months. Seth Gordon has met with two cases at the operating table and it is of interest to recall that Paasler performed the first nephrectomy on a single kidney misplaced in the pelvis in the belief that he was dealing with an ovarian mass.

The kidney when lacking is usually absent on the left side and the remaining organ, while often in its normal position, may be found in any part of the abdomen or pelvis. They are usually functionally sufficient, as evidenced by the seventeen cases reported by Newman<sup>18</sup> all of whom lived beyond the age of sixty. This is explained by a true hyperplasia of the renal tissue. The ureter and blood vessels of a single unilateral kidney are normal in the majority of cases but may show many variations.

Rudimentary development of one kidney is of the same practical importance as unsymmetrical kidney and of the same comparative frequency.

(b) The very much more practical question of unsymmetrical kidney resulting from pathological destruction to its fellow is of too wide scope to be discussed in this paper.

(c) Congenital fusion of the kidneys. Solitary kidney. This abnormality finds its most frequent expression in the horse-shoe kidney, the simplest type, which Rokitansky<sup>19</sup> calls the "lowest degree of fusion." On the other hand the kidneys may be fused into a discoidal mass lying usually in the median line, misplaced downwards, and often provided with a double pelvis and two ureters. This represents the "highest degree of fusion," and between these extremes are grouped the various intermediate forms. These morphologic variations are best understood if we recall Epstein's conception of their formation as the result of "fusion of the two kidneys at single points." It is impractical to satisfactorily classify the



resection, but in spite of the fact that no preliminary ligation was done, the hemorrhage was not very alarming. He could recall other cases where he had not tied the vessels in the neck and had never had serious bleeding. If we limited the ligation to one side of the neck, the anastomosis was often so free that it would have little effect upon the hemorrhage. He thought it was better to tie the vessels as they were cut.

DR L. W. HOTCHKISS said he had seen many of these operations on the upper jaw, and had had considerable personal experience with them. Dr. McBurney and Dr. Hartley and most of the other men with whom he had been associated had never resorted to a preliminary ligation of the external carotid. In the case shown by Dr. Lilienthal the ligation, as he understood it, was done for the purpose of starving the growth, thus aiding in the prevention of a recurrence, rather than to check hemorrhage.

DR MOSCHCOWITZ said he had operated on the superior maxilla, both with and without a preliminary ligation of the vessels in the neck, and he had come to the conclusion that such a procedure was a snare and a delusion. A year ago last summer he extirpated both superior maxillæ for a malignant growth. He did a preliminary ligation of the external carotid on one side, and intended to do the same on the opposite side. The artery, supposed to be the external carotid, was partially exposed and ligated. The operation was then completed without incident. The patient died three days later, and at the post-mortem it was found that on one side the common carotid had been tied, probably giving rise to a degenerative process in the brain.

Dr. Moschcowitz said he mentioned this instance, as he understood that Dr. Lilienthal had tied the common carotid in his case.

DR F. KAMMERER did not think that preliminary ligation of the external carotid on the affected side controlled hemorrhage during resection of the superior maxilla; the procedure was, furthermore, unnecessary where so large an opening was made to expose the seat of the disease, and where the individual vessels could be so easily caught and ligated. However, he considered ligation of both external carotids a valuable preliminary procedure in extended operations on the nasal and oral cavities, as, for instance, in Kocher's temporary resection of

pyonephrosis, are the most frequent complications. Pressure of anomalous vessels on the ureter, as Wm J Mayo<sup>24</sup> has shown, is the cause in the majority of cases. Rovsing<sup>25</sup> has demonstrated that pain across the abdomen from one renal region to the other, relieved by rest, increased by exertion, especially hyperextension of the spine, in the presence of an abdominal tumor in the mid-line, is suggestive of horse-shoe kidney, although tuberculous mesenteric lymph nodes may give the same symptoms. This author divided the isthmus of a horse-shoe kidney transperitoneally with relief of all symptoms. Mackenzie operated for pelvic tumor and found a large ectopic horse-shoe kidney. Papin and Christian<sup>26</sup> found at autopsy hydronephrosis in fifteen horse-shoe kidneys, and note that patients have been operated on for this condition by Albarran,<sup>27</sup> Israel,<sup>27</sup> and others. Thompson collected six cases of hydronephrosis, six cases of calculus, two of which had pyonephrosis, one case of pyonephrosis without calculus and one case of sarcoma. He successfully performed heminephrectomy for pyonephrosis in the left half of a fused kidney. Eisendrath<sup>28</sup> and Deaver<sup>29</sup> did laparotomies in the belief that they were dealing with inflammatory masses of appendiceal origin and found hydronephrotic horse-shoe kidneys. Bockenheimer<sup>30</sup> successfully removed a cystic tumor and Harris<sup>31</sup> divided the isthmus and removed the left half for tuberculous infection. Similar cases have been reported by Sutherland<sup>32</sup> and Edington<sup>32</sup>. Morris illustrates calculi impacted in each ureter of a horse-shoe kidney. Of twelve cases of unsymmetrical kidney found in the literature by Nessler, nine died of stone in the pelvis or in the ureter. A D Whiting<sup>33</sup> recently had a case of anuria from calculus obstruction of the ureter of a single kidney. Polk's case of nephrectomy of a single kidney for the relief of ovarian pressure pain illustrates the pelvic pressure symptoms which may arise from this condition. Obstructed labor has been caused in a number of instances.

Manley<sup>34</sup> and Gould report carcinoma, and Gordon sarcoma in unsymmetrical kidneys. The modern methods of

not very rare Bone had been found in various organs and tissues, including the dura and pia mater, in the scleroid and choroid, in the tonsils, in the thyroid, the lung and pleura and other serous membranes It had also been found in the endocardium, the stomach, the liver, the kidneys, the adrenals, the ovaries, the Fallopian tubes, the urinary bladder, the testicles, the arteries, muscles, lymph nodes, and the skin In the case reported by Dr Gerster the formation of bone in an organ like the penis interfered with the function of that organ in other locations its presence was merely an incident Personally, Dr Mandlebaum said, he had found abnormal deposits of bone in a number of cases, half a dozen or more, once in the liver and a few months ago in a small fibroma which was removed from a woman's thigh

# TRAUMATIC HYDRONEPHROSIS.

WITH REPORT OF A CASE

BY W. EARLE DRENNEN, M.D.,

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THE part played by traumatism in the etiology of hydronephrosis for a long time remained obscure. Although reports of cystic kidneys with a preceding traumatic history were relatively common, especially in the eighties of the last century, nevertheless, for the most part, they were not convincing. The accounts were fragmentary, the histories missing, the autopsy and operative findings obscure or lacking.

Wagner, in 1894, first established the significance of traumatism in the causation of hydronephrosis by his continuous observation and exact account of a case. At this time he was able to collect from the literature ten authentic cases of this condition. To this he later added three more. Wildholz, in 1910, reported a case which he had observed, and contributed a thorough critical review of all the cases in the literature.

Legueu distinguishes between three groups of cystic kidneys with which traumatism is associated.

1 *True Traumatic Hydronephrosis*—This is a dilatation of the kidney pelvis at the expense of the kidney itself, and presupposes an obstruction, more or less complete, of the ureter. In other words, it has all the physical characteristics of an ordinary hydronephrosis, but owes its origin to the result of some traumatism.

2 *Pseudotraumatic Hydronephrosis*—This is really a perinephrosis with extravasation of urine, and possibly blood, into the surrounding tissues. In such cases, a well defined sac often develops. Especially is this the case in young individuals.

3 *Ruptured Hydronephrosis*—That is, of an ordinary pre-existing hydronephrosis, the rupture being due to trauma.

tration which might as well have been placed in the immediate company of the picture

Contrary to its title, the book deals also with after-treatment in some cases. The translation has been well done, but in many instances idiomatic German is responsible for leaving the reader somewhat confused as to the meaning intended.

Intubation anæsthesia is not described, nor is the American positive pressure method in thoracic surgery. The references to the literature are almost wholly German. But eight American surgeons are mentioned. The author practises in his clinic anterior gastro-enterostomy in preference to the posterior operation. He states that the anterior operation is the routine technic in many large clinics and hospitals, year in and year out, and is practised with the best success.

We search in vain for the modern operations for aneurism, for transplantation of joints, and for joint resections. The description of operation for fracture of the patella is inadequate. The operations for cleft-palate and harelip are admirably described.

It cannot be said that we have too many books on surgical operations. Each is excellent in some respect. This book is by no means superfluous. It crystallizes the methods of an experienced surgeon. We cannot have too many such books if the surgeons can afford to write them.

J. P. WARBASSE

DIE CHIRURGIE DER BLUTGEFÄSSE UND DES HERZENS. By ERNST JEGER, M.D. 328 pages, 231 illustrations. Berlin. August Hirschwald, 1913.

By reason of the fact that progress in the surgery of the blood vessels has been dependent for the most part upon comparatively recent experimental work and has consisted in the development of a highly specialized technic, Jeger's work is in the main a discussion of the technical aspects of this branch of surgery as applied to laboratory animals and the significance in experimental medicine of the procedures dependent upon this technic. The indications, applications and results of vascular surgery in man are given secondary but sufficient consideration,

hydronephrosis, there are still others, secondary ones. For example, a single traumatism may lead to floating kidney, and this in turn to obstruction of the ureter and then to hydronephrosis; and again, a blow over a calculous kidney may dislodge a small stone, with subsequent impaction in the ureter, resulting in a true traumatic hydronephrosis (Parker's case).

It is remarkable that of the few authentic cases of true traumatic hydronephrosis on record, less than a score in all, that two of these, and a third probably, should have occurred in individuals with solitary or horseshoe kidneys. However, it is not hard to conceive that such kidneys easily lend themselves to injury and displacement, both by reason of their increased size and weight and their less secure anchorage.

Aside from the trauma, the symptoms of true traumatic hydronephrosis do not differ from congenital cystic kidney, or from hydronephrosis acquired in other ways. Closely associated with the injury, there may be hæmaturia, but contrary to the statement of Delbet, this does not occur in all cases. It has been observed in slightly less than 50 per cent of the cases which have been reported. The size of the hydronephrotic sac varies, according to the nature of the ureteral obstruction. The larger sacs are found where the obstruction has been intermittent or slowly progressive. When the obstruction is sudden and complete, the tumor is apt to be quite small.

Formerly only subcutaneous injuries of a violent nature were deemed capable of causing a true traumatic hydronephrosis. That percutaneous wounds may lead to this condition has been proven by the cases of Marvel and Kroner, the one being a gunshot wound dividing the ureter, the other a bayonet stab.

The probable diagnosis of true traumatic hydronephrosis is based on the preceding traumatic history and the clinical symptoms pointing to a hydronephrosis, viz. a fluctuating tumor, retroperitoneal in position, originating in the kidney and developing insidiously, its contents consisting of more or less altered urine.

eral surgical information, but the fact that the new phases of vessel surgery which have a proved practical application in man are at present very limited and have for the most part appeared in recent and generally accessible American periodicals, minimizes the practical value of the book for the American surgeon

EUGENE H POOL

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## TRAUMATIC HYDRONEPHROSIS

Reporter Year	Nature of trauma	Time elapsed between re- ceipt of injury and appearance of tumor	Age, Sex	Size of tumor Side of body	Hematuria	Operation or Autopsy.	Pathological Condition	Result
Py-Smith, 1871	Horse kick in abdomen	2 years	24, male	Held 3 quarts Side not stated	Yes	Autopsy	Impervious stric- ture of ureter	Died of intur- rent disease
Lepine, 1880	Schrapnel shot	10 years	45, male	"Well marked tumor." Side not stated	No	Autopsy	Impervious stric- ture of ureter	Died of uremia
Deleiturez, 1890	Number of falls	"A few weeks"	10, female	"Large tumor," right side	Yes	Transperitoneal nephrectomy	Not described	Recovery
Bardenhauer	Fall on stairs.	4 weeks	12, male	Size man's head Left side	No	Nephrectomy	Kidney a large sac, papillae flattened	Died 1½ years later, amyloid disease
Postemski, 1893	Contusion ab- domen	Few days	12, male	"Large tumor," right side	Yes	Nephrectomy	Ureter severed. Kid- ney a mere large sac	Recovery
Fenger, 1894	Severe fall on side	10 years	47, female	"Large tumor," Side?	No	Plastic on ureter	Ureter imbedded in scar tissue and strictured	Recovery.
Wagner, 1894	Fall on steps	3 weeks	10, male	"Large tumor," right side	Yes	Nephrotomy	Calices and pelvis dis- tended Papillae flattened	Recovery Pat- ency ureter re- established
Bartlett, 1895	Fall from horse	1 year	16, female	Occupied entire left side	No	Nephrectomy	Stricture ureter Kid- ney parenchyma de- stroyed	Recovery
Gerster, 1897	Fall on side	6 months	9, male	Size child's head Side?	No	Nephrectomy		Recovery.
Marvel, 1899	Gun-shot in back	10 days	4½, female	Size? Side?	No	Nephrectomy		Recovery.
Eichler, 1901	Struck by fall- ing beam	3½ weeks	38, female	Left side	Yes	Autopsy	Horseshoe kidney, only one ureter, it strictured	Died of uremia
Delbet, 1903	Fall from horse	15 months	23, female	Size of fist Left side	No	Nephrectomy	Ureter partially con- stricted Kidney movable	Recovery
Kroner, 1907	Bayonet stab	8 weeks	Adult male	Palpable tumor Side?	Yes	Nephrotomy	Blood clot in ureter which regained pat- ency	Recovery
Schaad, 1907	"Severe tran- sma."				?	Nephrectomy	Pelvis of kidney a sac	Recovery
Ferron, 1909	Kick in abdo- men	Few weeks			?	Nephrectomy	Dystopic, due to trauma	Recovery
Cordero, 1909		Short time				Nephrotomy	Whole kidney des- troyed A mere sac remaining	Recovery
Waldholz, 1910	Log fell on abdomen	3 weeks	25, male	Child's head Left side	Yes	Nephrectomy	Stricture of ureter Pel- vis and calices dilated	Recovery
Drennen, 1913	Sudden jerk upward	4 months	22, male	Child's head Right side	No	Nephrotomy of kidney	Solitary kidney Ure- ter kinked	Died 1½ years later of uremia



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few days to splint the ureter and prevent a return of the kink

A purse-string suture of chromic gut was then passed well down in a puckering manner around the sac and the whole lifted up and sutured to the twelfth rib. A large drain was left reaching into the sac and emerging through the skin and the wound closed about it

That this is a case of *true traumatic hydronephrosis* cannot be doubted. The history of the injury, and the resulting intermittent hydronephrosis make it clear that the solitary kidney was undoubtedly dislodged from its normal position by the traumatism

During the first twelve hours after the operation a considerable amount of urine escaped through the lumbar wound, and a half ounce was obtained from the bladder with the catheter. The patency of the ureter had become reestablished. During the second twelve hours, one ounce of urine was voided. He passed more and more urine in the natural way, and at the end of two weeks was voiding over twenty ounces daily, although a considerable amount still escaped through the lumbar wound. At the end of three weeks he was out of bed, passing more than thirty ounces daily through the bladder, and less than an ounce from the lumbar wound, which had almost closed. The urine was always of low specific gravity, about 1008, and contained much pus

During convalescence he was cystoscoped, and only one ureteral orifice could be found. Attempts at radiographing the ureter injected with collargol were not successful. At the end of three weeks the sac was capable of holding sixteen ounces of fluid injected through the lumbar fistula. At this time, having gained in strength and flesh, he left the hospital for his home in a remote part of the state, and was lost sight of for the next five months. At the expiration of this time, he presented himself for treatment in the hope of having the fistula closed, which was very small and easily controlled by a small piece of rubber tubing with a wooden plug in the end for a stopper. A suggested plastic operation on the ureter to

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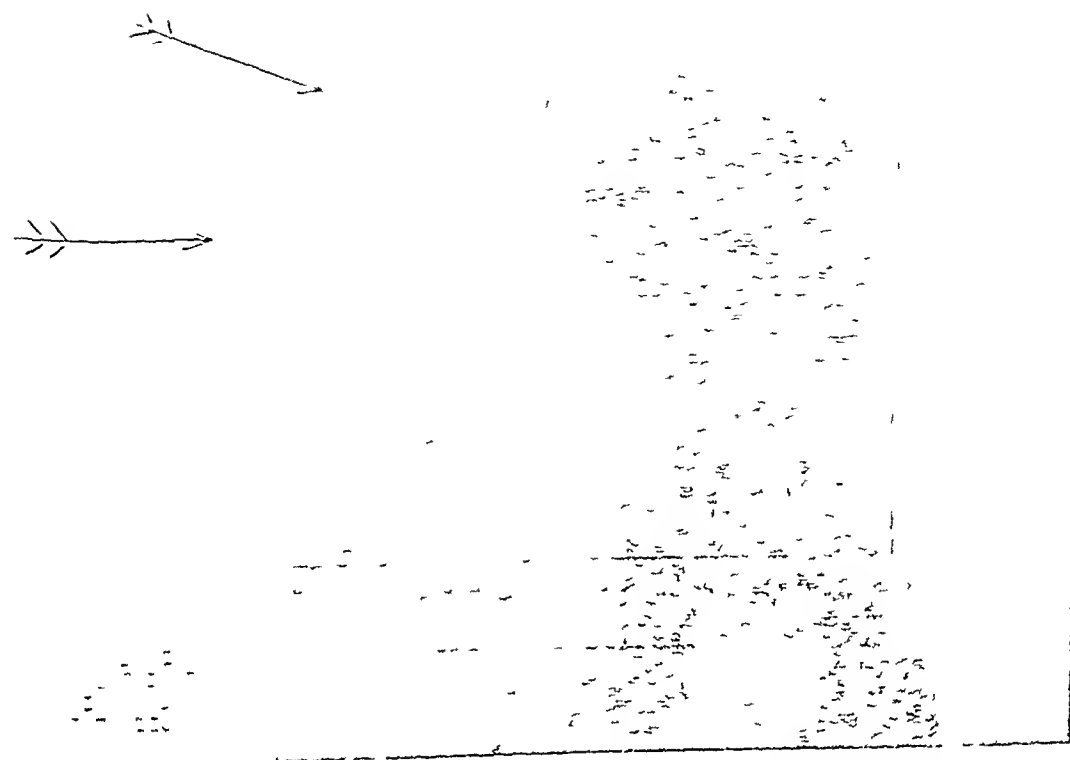
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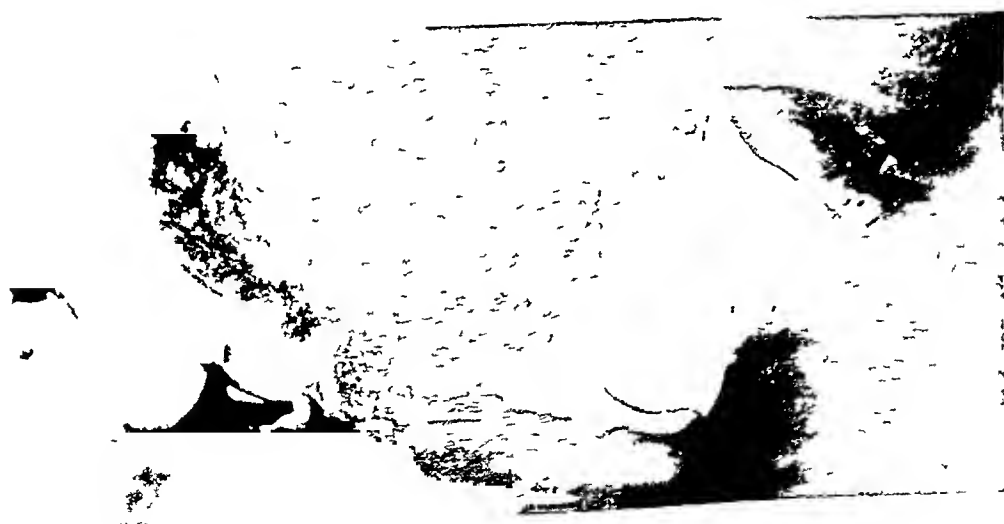
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FIG 1



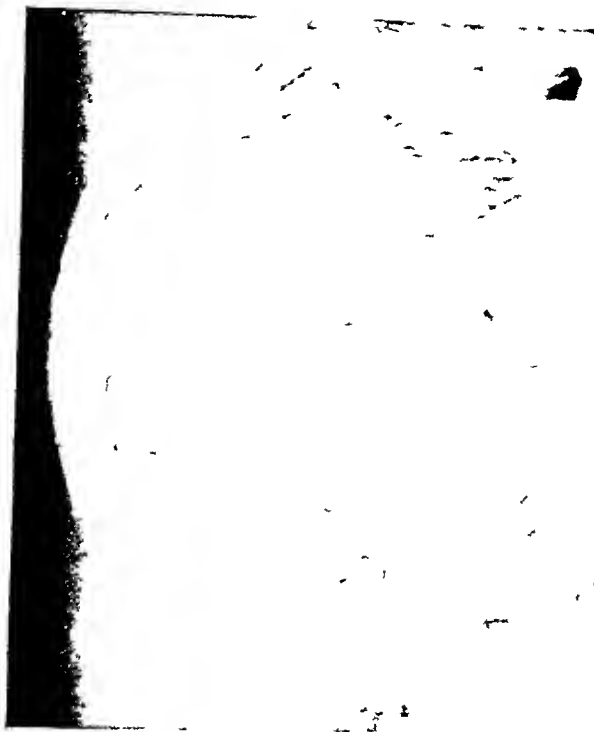
Upper pole of right kidney showing collargol infarct and irregular diffuse infiltration of the renal cortex

FIG 2



The collargol extends in the form of a broad wedge or fan from the tip of a calyx into the cortex and under the capsule (Enlarged about 4 times)

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sections stained with hemotoxylin and eosin, and with hemotoxylin and carbol-fuchsin. The most painstaking search fails to reveal the presence of tubercle bacilli. The tubules contain a black substance (collargol) distributed through their entire length and extending into the glomeruli. In certain tubules and glomeruli a relatively small quantity is present, and is then found as a thin layer closely applied to the cells (Figs 3a, 3d and 4a).

These doubtless represent tubules which were involved by the first injection of collargol, in 15 per cent suspension and which escaped invasion at the later injection. Other tubules are filled solidly by a dense mass of collargol, or at most, a certain small admixture of cells and detritus (Figs 3b, c and 4). These are the tubules involved by the second injection of more concentrated suspension.

In either case the tubular epithelium is, with very few exceptions, completely necrotic. Certain tubules have completely broken down, permitting the collargol to diffuse through the surrounding tissue. In a few tubules, however, the epithelial nuclei still stain, but show necrobiotic changes, viz., karyorrhexis and karyoschisis. In addition the cells contain globules of collargol, indicating that the cells have exercised a phagocytic function (Fig 4). This same illustration shows at its centre a glomerulus containing collargol. The capillary endothelium is swollen and hydropic, and the capillary tufting has entirely disappeared. No wandering cells (leucocytes) are present. The glomerulus is converted into a cell mass somewhat resembling a young tubercle.

The tubules are widely separated by cellular exudate, which is, however, so badly degenerated that for the most part little can be made out as to the character of the cells composing it. Here, also, as in the tubules, there is marked karyoschisis and karyorrhexis. In a few areas the cells composing the exudate are better preserved. Here the cells are chiefly mononuclears, viz., endothelial leucocytes, lymphocytes and lymphoblasts, and plasma cells. In one area only was found a collection of eosinophile polynuclears, and myelocytes.

Fig 5 shows a vein with marked thickening of the intima. The media contains many small droplets of collargol and about the vein is a massive exudate, the cells of which are necrobiotic. Outside of the affected area, the kidney is œdematous. There are a few obliterated glomeruli and here and there moderate or slight proliferative capsular glomerulitis.

It seems possible to reconstruct with fair accuracy the course of the changes which have taken place. The fluid having found its way into the tubule, passed through its entire length, and excited changes analogous to those seen in tubular nephritis of toxic origin. The exudate collects partly under the influence of the collargol itself, but no doubt chiefly under the influence of decomposition products derived from the destroyed parenchyma. It is noteworthy in this connection that the cells of the exudate correspond closely in character with those ordinarily found in toxic tubular (acute interstitial) nephritis. Since in the latter condition a complete *restitutio ad integrum* occurs, provided the patient survives the early stages of the process, it is not unlikely that the present case

delivering such a fluid from an average piston, hand syringe, through a number seven catheter and into the renal pelvis. After some four tests it was found that the average was 60 mm., the pressure varying from 40 mm minimum to 80 mm maximum.

Sections were also studied by Dr Whitman from one of the pig's kidneys (Fig 5) into which collargol had been injected. This kidney is shown in Fig 7. The arrows point to the areas invaded by the collargol. Dr Whitman's report follows.

"Sections through the area discolored by collargol show the latter within some tubules, sometimes as a solid mass lying free in the lumen, sometimes as a thin membrane adhering closely to the surface of the epithelial cells.

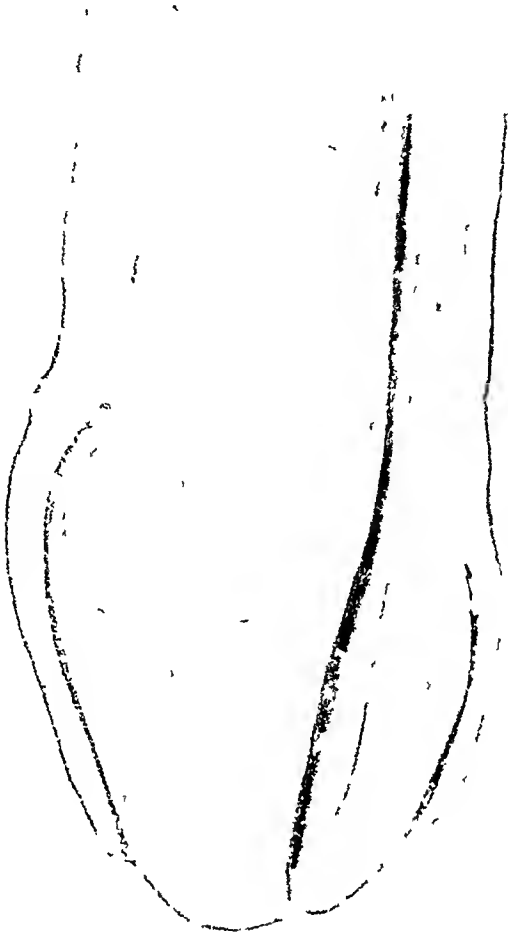
"Tubules of every class are involved. The collargol can be found even in the proximal convoluted tubes just outside of the glomerulus, but no glomeruli containing collargol are found.

"Inflammatory changes are of course absent, nevertheless the collargol is found here and there within the cells of the tubes, in essentially the same manner as in the tissues from the patient (shown in Fig 4). This can only be explained on the assumption that the cells still retain, in part at least, their phagocytic properties, by virtue of which they have actively taken up particles of the collargol."

I am indebted to my assistant Dr F H Carpenter for valuable assistance in these experiments.

NOTE BY DR STOVER—Out of some forty instances of injection of the ureter and renal pelvis under pressure, for the purpose of demonstrating an early hydronephrosis due to ureteral obstruction, I have seen but two examples of infiltration of the renal parenchyma. I have known of no later-appearing evidence of damage to the renal tissue. Yet I favor the use of a standardizable gravity injection method, and think this would obviate the present small possibility of harm from renal collargol instillation. The cuts here reproduced of the stereoskiagram show the whole kidney blotched, while the area of infiltration was really confined to the upper pole area.

FIG 1



Author's case of tuberculosis of glans penis. Note the correct  
upper half of the pen.

The age of the patient, the mode of onset and the very firm consistency of the growth suggested the possibility of malignancy. The possibility of calcareous deposit and of bony growth was considered. A frozen section of the growth was examined by Dr. Tiedemann and malignancy was excluded. A few days later Dr. Tiedemann reported the growth to be due to tuberculosis of the glans penis.

The growth was then excised. The appearance presented by a median section of the growth is shown in Fig. 1.

exactly. The thickness is estimated to be about two or three millimetres. There is considerable subcutaneous lateral mobility which easily permits a tilting on edge from either side, the tilted body then assuming the shape of a longitudinal crest. No longitudinal mobility. The Wassermann test proved to be negative. Urination unimpeded. Urine of high specific gravity (1018-1022), clear, dark amber, acid; no albumin, no sugar, no blood, pus, or casts.

October 15, under light gas and ether anaesthesia extirpation of the body. Artificial anaemia by constriction of root of penis. Longitudinal median incision down upon the body, severing the penile fascia. Very easy dissection of the lateral margins, the inferior attachments of the osseous body to the tunica albuginea and to the septum penis demanded cutting. After the removal of the body a defect of the tunica extending over both corpora cavernosa was visible. Catgut suture of tunica albuginea, release of the constrictor, ligature of two small arteries, suture of the fascia and skin, together with a small compressive dressing completed the little operation. Uneventful primary healing followed.

February 24, 1911, patient reported that the upper incurvation had been sufficiently reduced to permit satisfactory sexual intercourse, but was still apparent. He feared a return of the condition.

The pathological findings of the specimen were as follows:

*Pathological Report*—The specimen measures 3.5 cm  $\times$  1.7 cm  $\times$  2 to 3 mm, and is a flat, thin plate of tissue containing areas of bony hardness. The specimen is covered on one side by dense connective tissue of a whitish color, and on the other side by tissue of greyish white color. An X-ray photograph shows a dark shadow running in an irregularly serpentine fashion from side to side, and one extending longitudinally. After fixation and hardening in alcohol, several pieces extending across the entire specimen were decalcified in nitric acid, 5 per cent., and imbedded in celloidin. The cut sections were stained by various methods.

The bone runs through the middle portion of the sections, and the surrounding tissues are of different character on either side. On one side there is a layer of extremely dense fibrous tissue showing a moderate number of compressed nuclei and a few small blood-vessels, and staining faintly with haematoxylin. Although a sharp line of demarcation is noted between the fibrous tissue and the bone, the two are in close relation. The different staining qualities of the two types of

FIG 1



Specimen Dark bands represent bone tissue

FIG 2



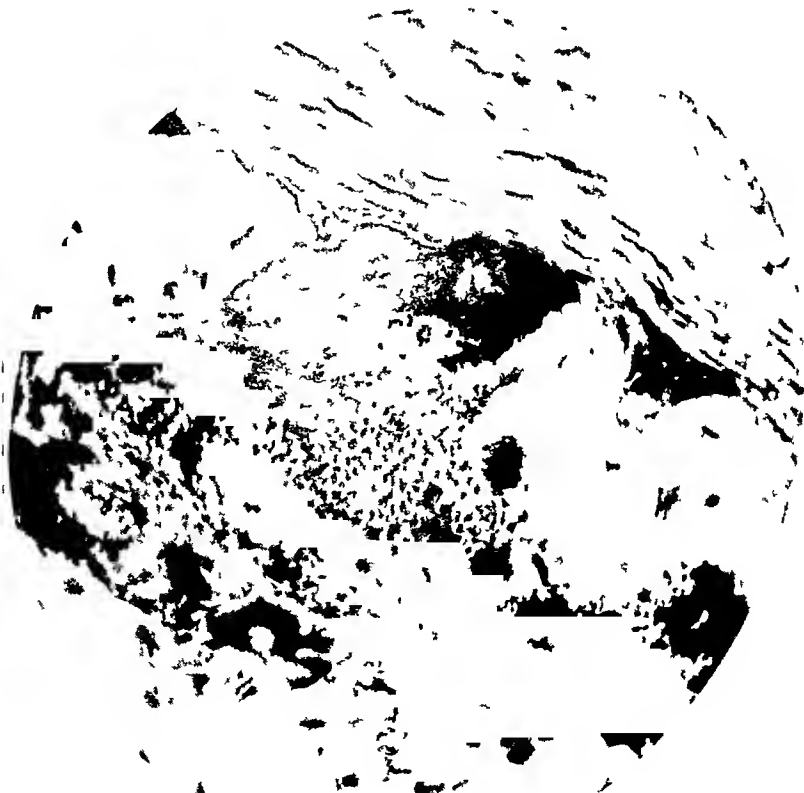
The entire field excepting areas of fibrous tissue above and below shows new bone tissue

FIG 5



Most of the field is occupied by young vascular connective tissue. On the right is an area of osseous tissue and calcareous matter. The pale band above is osteoid tissue. Five osteoclasts are seen in the centre of the field.

FIG 6





Verth (Kiel)<sup>3</sup> and this, our own case, which makes the sixteenth.

There is no reason to assume that the ossification of certain parts of the fibrous structures of the human penis stands in a morphological relation to what is observed in certain quadrupeds under the name of *os priapi*. Mayer's endeavor to prove such a relationship by the description of a penile cartilage in the glans of the negro was rejected by Hyrtl, who found that the problematic cartilage lacked the characteristic structure and was nothing but a thickening of the anterior portion of the septum of the corpora cavernosa.

Among the etiological factors determining ossification of parts of the tunica albuginea, and the corpora cavernosa, Sachs mentions gonorrhœa, syphilis, diabetes, rheumatism, and traumatisms. Each of these affections may be accompanied by characteristic deposits leading to induration and ossification. Traumatisms, causing minute hemorrhages, may also have their share in the causation. Zur Verth, who limits the term of *plastic induration of the penis* exclusively to the cases of elderly men, in whom a slow and painful development of lamella shaped bodies on the upper surface of the penis undergoing osseous transformation is observed, attributes the phenomenon to two factors. The first one is an arteriosclerosis due to systemic causes such as were enumerated above; the second are the many small traumatisms accompanying erection and the sexual act, or in fact any other non-sexual traumatism, such as was noted in our case in the frequent impingement of the unyielding and sharp edge of a corset where the root of the penis is immovably fixed to the symphysis pubis. The primary seat of the induration is the fascia penis, which is very rich in elastic fibres. The process is analogous to the degeneration of the elastic fibres of the blood-vessels caused by the disorders of assimilation in the senile state, especially in the presence of intoxications and traumatisms.

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<sup>3</sup> Zentralbl f Chir, 1912, p 1743

blood-vessels, nerves, and nerve endings were invariably and characteristically altered. These changes, with superimposed minute traumatisms, offer a plausible explanation of the genesis of the affection, a view which is not fully accepted by Frangenheim, but is advocated by Zur Verth, and is endorsed by ourselves. Siegmund's theory of the ossification of the lymphatic vessels and Waelsch's<sup>5</sup> assumption of the presence of chronic phlebitis and periphlebitis as causative factors are not borne out by our findings.

Although the occurrence of bone formation in various organs is not at all infrequent, the underlying causes, as well as the exact mode of its production, are still unsolved. From a study of the material in this case, it seems not unreasonable to assume that the bone has been formed in the connective tissue by a process of metaplasia. The presence of the osteoclasts and the young connective tissue and their relations to the lime salts seem to warrant this assumption.

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<sup>5</sup> Über die Induratio penis plastica. *Munchener med. Wochenschrift*, 1906, No. 41.

suddenly attacked by severe abdominal pains in the right side, the condition became worse, and an operation was performed, which showed a peculiar configuration of the cæcum. The wall was made up of masses of globular structures, from the size of a sand grain to that of a hazel-nut, they appeared semi-transparent and filled with gaseous contents. Puncture of the cysts caused the gas to escape with a hissing noise, followed by collapse of the vesicles, which covered the entire cæcum and the lowermost segment of the ileum, terminating without a distinct boundary about 3 cm above Bauhin's valve. A segment of omentum near the cæcum, but not adherent to it, was likewise interspersed by gas cysts of variable size, so as to form a tumor the size of an apple, which crepitated on contact. The mesocolon was swollen and emphysematous, it contained numerous swollen glands, one of which was removed for examination. A piece of omentum was likewise ligated and resected. The affected parts presented no signs of recent or chronic inflammation. The appendix was similarly emphysematous and infiltrated, it was resected, and the stump was buried through circular suture of the cæcum. Further surgical treatment seemed impossible, in view of the great extent of the gas infiltration, and was not attempted. As there was no trace of exudate and the appendix showed no gangrenous spots on macroscopical examination, the wound was closed by primary sutures. Next day, the patient complained of pain and pressure in the abdomen, the wound looked well and was not opened. The abdominal walls "crackled" very extensively, but inflammatory phenomena were absent. This crackling subsided promptly, the wound healed by first intention, and the patient was dismissed in excellent condition on the twelfth day after the operation. He was re-examined six months later, at which time he felt and looked perfectly well.

The report on the excised tissues and the appendix, from the Pathologico-Anatomical Institute of the University of Marburg, was as follows. The appendix shows a local, rather extensive necrosis, and in the surroundings of the necrotic area and the hæmatomata bacteria are demonstrable. The adjacent lymph vessels are much dilated, apparently through gas or air infiltration. Bacteria cannot be positively demonstrated in the lymph gaps themselves. The piece of omentum presents the same pneumatic dilatations of lymph vessels, likewise without demonstrable bacteria, remnants of a fibrinous exudate are found in certain areas in the dilated lymph vessels of the omentum.

The following observation of Duverney, 1747, quoted by Combalusier (*Pneumo-Pathologia*, 1747, p. 17), should be interpreted as a post-mortem gas formation, i.e., a putrefactive emphysema, in the opinion of Winands (*Ziegler's Beiträge zur pathol. Anat.*, vol. xvii, 1895, p. 38).

At an autopsy, a large portion of the intestinal tube was found to be studded with broad, long, annular swellings upon the outer membrane. These swellings seemed to be filled with a whitish substance, and on digital pressure yielded a crackling noise, like small air-filled vesicles. When opened, they were seen to be entirely filled with white, perfectly empty cells. On turning the bowel inside out, the same swellings were

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, held February 3, 1913*

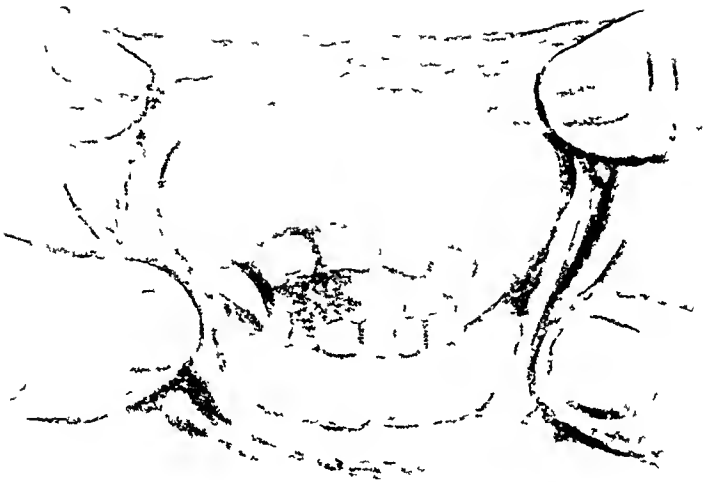
The President, DR GWILYM G DAVIS, in the Chair

## SYMMETRICAL ODONTOMA OF BOTH SUPERIOR MAXILLÆ

DR MORRIS BOOTH MILLER presented a female mulatto child two years of age. The history briefly is as follows. She was born on February 3, 1911, prematurely a little less than seven months after conception. Her mother has since given birth to another child by the Cæsarean route. While the child was prematurely born, she seemed to get along well until last summer, when it was noted that her face was changing in outline, and the mother and grandmother thought she was getting fat. The dentition of the milk teeth was apparently normal so far as could be learned. There is nothing else of significance in the history.

There are abundant signs of rickets as shown by the beaded condition of the ribs, epiphyseal enlargement, and bowing of the limbs. The child shows a positive von Pirquet reaction, negative Wassermann, and the blood count gives no variation from the normal except a low polymorphonuclear count, 31 per cent, the lymphocytes being 41 per cent and the large mononuclears 22 per cent. There is nothing of interest in reference to the nose condition.

It will be seen on examination that there is an extensive overgrowth of the entire alveolar portion of both jaws but not extending beyond the alveoli (Figs 1 and 2). The general effect upon the face is to slope the facial angle to an accentuated degree of prognathousness. The palate arch is lowered. The overgrowth in each jaw is perfectly symmetrical on either side of the midline, and from within out there is an equal amount of swelling on both sides of the line of the teeth (Broca's sign) (Fig 2). The latter are widely spaced, show the loss of enamel



Odontoma involving both superior maxillæ as seen upon retraction of lips

in two places with a butcher's cleaver. On the anterior and radial aspect of the arm near the wrist there was a long oblique wound which severed the tendons of the flexor carpi radialis, extensor ossis metacarpi pollicis, extensor primi internodi pollicis, the radial artery and the radial nerve. The radius had a chip cut from its lower end, a slice of bone was cut from the base of the metacarpal of the thumb, and the wrist joint was opened. On the ulnar surface there was a transverse wound which cut through the ulna and the adjacent muscles at the junction of the upper and middle thirds.

In the wrist wound the pieces of bone were sutured in place and the joint closed without drainage. The radial artery was tied but the severed nerve and tendons were carefully sutured. The upper arm wound also involved muscle suturing. The patient made a smooth aseptic recovery. Six years have now elapsed and it is interesting to note the full strength and normal mobility of the structures affected and the perfect restoration of sensation over the distribution of the radial nerve.

DR J LEON HERMAN presented a specimen of dumb-bell kidney, and discussed the subject of such malformation in a paper for which see page 868.

DR J CHALMERS DA COSTA said that recently he had blundered on one of these cases in his clinic. He thought he had a hypernephroma to deal with and after working for an indefinite period found out what he really had, and decided to retreat. The renal band went from the top of one kidney across to the other. The ureters had been catheterized before operation and there was no suspicion of such a thing as a horse-shoe kidney existing.

DR GEORGE G ROSS related a recent experience in kidney surgery as follows:

A woman came to him with a tumor in her right loin which had been present for 12 years. She had been operated on once with a mistaken diagnosis of gall-stones. The diagnosis of pus kidney, however, was plain. The usual incision was made and as soon as he exposed kidney, which was 10 inches long, 4 to 5 inches thick, a broad and adventitious vessel,  $\frac{1}{8}$  inch in diameter, was seen going from the lateral wall into this kidney. The kidney was drained and she went on to convalescence. She left the hospital for home, got as far as Baltimore, where the

FIG 3



Sprain-fracture of spinous process of first thoracic vertebra. Upper arrow points to area of detachment, lower to displaced process

time" Scudder (Treatment of Fractures, 1911, p 92) says "More than 50 per cent of fractures of cervical vertebræ are fractures of the spinous processes" My case is, then, a sprain-fracture from muscular violence, most likely from intense contraction of the thromboidei muscles. Owing to the downward displacement, a pseudarthrosis is liable to ensue. Of 21 cases of complete pseudarthrosis Gurlt (*loc cit*) found 4 involving the spinous processes. This result is immaterial, however, and the spinous process could readily be excised.

### SERRATUS MAGNUS PALSY WITH PROPOSAL OF A NEW OPERATION FOR INTRACTABLE CASES

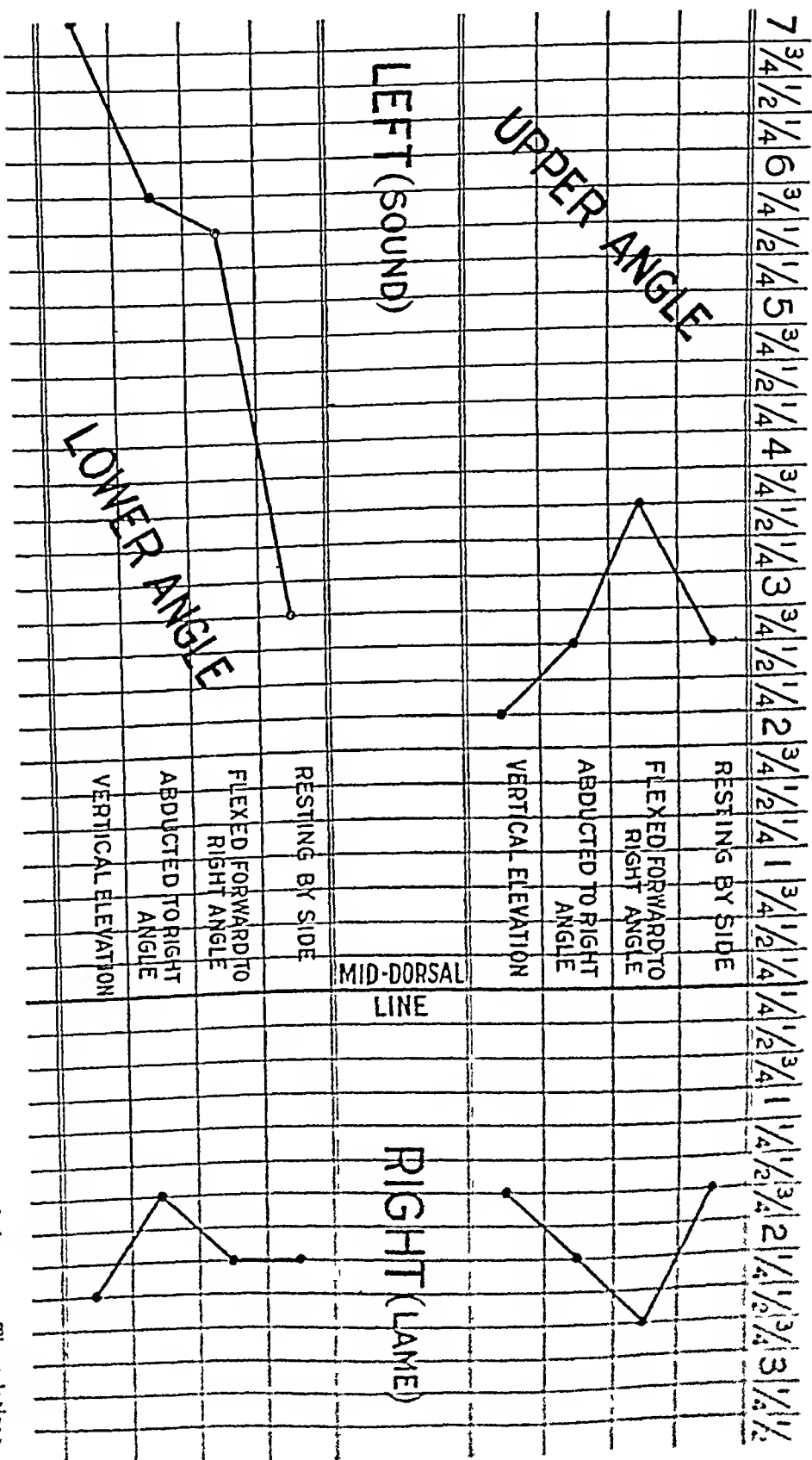
DR PENN G SKILLERN, JR, reported the case of a man, aged twenty-four, who reported at the Surgical Out-patient Department of the University Hospital, service of Dr B A Thomas, October 19, 1912, complaining of inability to elevate the right arm above the shoulder.

He is an apprentice machinist, and had been working at a machine which required full reaching forward of arms 800 times a night, and to this he attributes his present trouble. He awoke one morning with pains about right shoulder which on subsiding left stiffness and the lameness of which he complains.

The patient was stripped to the waist. The eye was caught immediately by the "winged" appearance of the lower part of the scapula (Figs 4 and 5). Seen from before there was drooping of the "point" of the shoulder (acromion). Viewed from the side the projecting inferior angle of the scapula was seen in profile behind, whilst before, with the arms elevated to the limit of their power, on the left (sound) side the lower five digitations of the serratus magnus were plainly visible, embossed in contraction between the external oblique before and the latissimus dorsi behind and were palpable as definite muscular cushions for the ribs. On the right side, however, these digitations were neither seen nor felt, and the ribs, having lost their muscular cushions, felt hard and bare. This is a sign indicative of atrophy of the serratus magnus. Behind, the scapulæ were outlined in black and the muscles inserting into them were marked on the surface with colored crayons. The inferior angle projected most when the upper extremity was flexed.



FIG 6



Graphic chart based upon the table showing relations of angles of scapula to mid-dorsal line in the four positions of the arm. The relation of the vertebral border to the mid-dorsal line may be figured by connecting the respective dots in the various positions. Contrast the wide forward and outward excursion of the inferior angle of the sound scapula with that of the lame.

of strychnia beginning with one-thirtieth of a grain thrice daily after meals

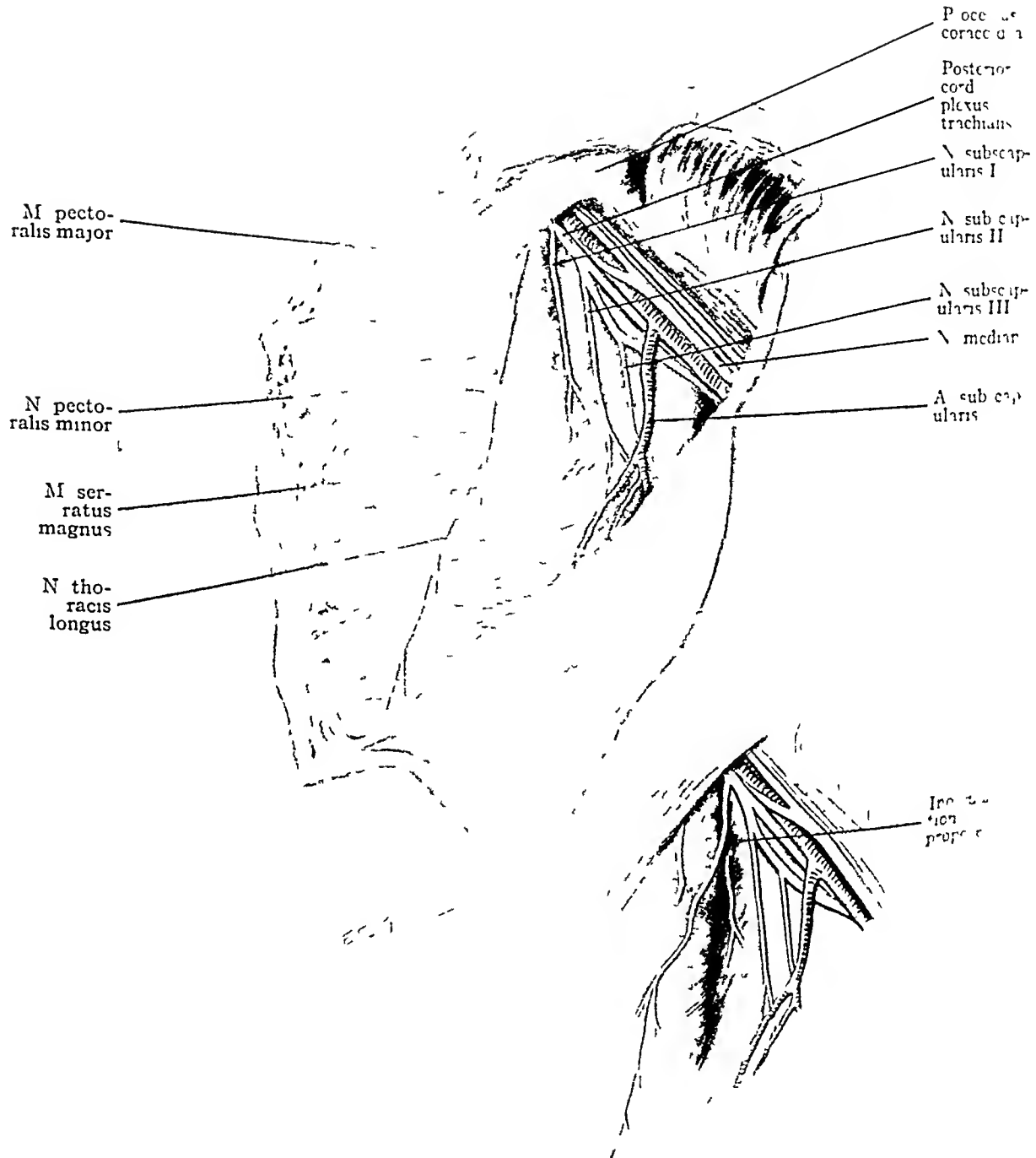
After over three months of this treatment without benefit, or any sign of improvement except that gained by education of the compensatory elevator fibres of the trapezius, not wishing to discharge the patient—just entering upon his life's work—uncured and permanently crippled, an operation was advised which is believed to be original, but which has not been tried yet, pending the consent of the patient

As to general considerations of serratus magnus palsy, Dr Skillern said that it was not germane to the object of his communication to deal with the commoner medical and for the most part better known aspects of this malady. A comprehensive paper by Eshner (Jour A M A, Feb 1, 1902) covers this ground. The literature is scarce, contributions by Gower and a monograph by Berger (1875), which covers many aspects of the subject, being the most valuable. He desired, however, to emphasize a few points which have to do with completely isolated and independent paralysis of the serratus magnus due to trauma

In the first instance the long thoracic nerve is exposed to trauma as it traverses the scalenus medius, after emerging from which its superficial position exposes it to the pressure of objects—especially sharp-edged ones—carried upon the shoulder, particularly as is commonly seen among laborers when the object is unloaded by a short quick shrug of the shoulder. Hecker, Jobert and Fuehrer have reported cases similar to the one now reported, and in which paralysis followed heavy work that required energetic lifting of the arm in frequent repetition. Wiesner attributes the injury in these cases to violent alterations of the entire supraclavicular fossa in shape and in position

The incidence of the malady in the present patient was similar to that in other cases in which continuous and severe action of certain scapular muscles was conspicuous in the etiology, in that it began without warning (and but slight pain) with a feeling of stiffness and weakness of the arm and then paralysis. Then the antagonistic trapezius, rhomboids and levator scapulæ, now unopposed and free to act, contracted and produced the above-depicted deviation of the scapula, whilst the serratus magnus, freed from its taskmaster—the long thoracic nerve—lay dormant and slumbering and shrivelling up upon the chest-wall. The

FIG 7



Proposed operation for serratus magnus palsy

to follow an atresia of these structures. For these reasons other methods of opening the kidney were tried, and after numerous experiments, the following procedure was found to accomplish the purpose with the very smallest degree of hemorrhage and comparatively little post-operative destruction of the tissues

First, a Carrel soft-jawed forceps was applied to the renal vessels. This instrument had sufficient elasticity to prevent the ingress of blood to the kidney, without excessive bite enough to cause any damage to the endothelium of the vessels. Then the kidney was opened with a sharp knife, care being exercised to avoid the poles of the kidney. It was invariably found that after the incision had been made, there occurred very slight gushing of blood, amounting, in my cases, to but a few drops and never over a drachm. After the necessary exploration had been done, the kidney parenchyma was approximated by through-and-through sutures of very fine silk. These sutures were applied according to Method III described in our previous communication. Great care was exercised in tying these sutures so as to avoid any possibility of strangulation. Then the clamps were removed, and the kidney allowed to drop back. As a result of this procedure, even when the cut surfaces of the kidney had been very lightly approximated by the sutures, there occurred no hemorrhage whatever.

One kidney split and sutured in this way showed at the end of ten days a very slight infarct (Fig 6), scarcely greater than those that come from a simple incision of the kidney without suture. In some of the animals that had been allowed to live for several months, at the end of this time there were found to be only slight differences in the weight and in size of the epithelial structures of the operated and unoperated kidneys, showing that comparatively little damage had been done. In some of these kidneys small areas of parenchyma had been lost, but apparently without the serious scars and contractures that follow some of the older methods of suture.

Fig 8



Enlargement of superficial cns consequent to

which dilated to accommodate the extra volume of blood, and after the subsidence of the superficial phlebitis they remained permanently dilated and kept on returning the extra blood, whilst the superficial veins contracted from the fibrous tissue which organized the thrombi. It seems scarcely necessary to theorize upon a coincident canalization of the thrombus in the vena cava for there were no signs of deep thrombophlebitis. The crural ulcers seemed to be healing.

#### LUXATION AT MIDTARSAL (CHOPART'S) JOINT

DR SKILLERN presented skiagrams showing a midtarsal dislocation. This history was as follows. A negro man, aged twenty-three, presented himself at the Surgical Out-patient Department of the University Hospital, service of Dr B. A. Thomas, on June 20, 1912, complaining of an injury to his right foot received the previous day in the following manner. While standing upon two iron beams with the heel on one, the ball on the other, and the arch spanning the intervening space, a third iron beam fell from a freight car four feet above upon the dorsum of the right foot. Examination revealed great swelling, which obscured bony landmarks upon the dorsum, tenderness over the astragalo-scaphoid joint internally, but more marked over the calcaneo-cuboid joint externally, and loss of rotatory movement but preservation of flexion and extension. There was no ecchymosis. Skiagram, taken by Dr Henry K. Pancoast (Fig 10) showed incomplete total luxation at midtarsal joint with sprain-fracture of antero-external corner of os calcis. The patient, a negro, refused an anaesthetic, but by manipulation somewhat similar to those used in the reduction of Colles' fracture, he restored the articular surfaces by plantar flexion followed by extension and rotation outward, and applied a gypsum case (Fig 11).

The reporter remarked that Petit (*Oeuvres complètes, Bibliothèque Chirurgicale*, 1837, I, p. 98) described the first two cases of this injury, but his as well as Sir Astley Cooper's (*Treatise on Dislocations and Fractures*; 1823, p. 376) cases were severely criticized by Broca (*Mémoires de la société de chirurgie*, T. III, 1853; p. 566) as having been based on insufficient evidence. Malgaigne (*Traité des Fractures et des Luxations*, 1855, II, p. 1071) was the first to name the injury, mid-

FIG 10



Luxation at mid-tarsal joint after reduction. Total increase in length of head of astragalus on dorsum

FIG 11



Luxation at mid-tarsal joint after reduction. Gap between tarsus but permit posterior tarsus to move

posticus. The astragalo-scaphoid joint is higher and more exposed than the calcaneo-cuboid, and its range of motion greater. It is the opposition joint of quadrupeds but has lost this significance in man, its most important function being to supplement or accompany movements of the ankle-joint. The combined units of the transverse tarsal joint furnish motions of slight plantar flexion and slight rotation about the longitudinal axis of the foot. Otherwise the tarsus has practically no mobility. The part of the foot in front of this joint-line may be referred to as the antetarsus, and that behind, the posterior tarsus.

Luxation here may be classified according to the involvement of one or both joints as partial or total, according to the extent as complete or incomplete; and according to the direction as plantar or dorsal. The present case, therefore, classifies as a total, incomplete luxation of the plantar type. It is total because both joints are involved, it is incomplete because the articular surfaces are still in contact inferiorly, it is of the plantar type because the antetarsus is lowered into the sole of the foot. Isolated luxation of the calcaneo-cuboid joint never occurs, but is precipitated by the astragalo-scaphoid joint taking the initiative, just as one mountain-climber is dragged down by another who has lost his foothold. There is usually a lateral displacement, in addition.

Predisposing causes are repeated sprains which relax ligaments, and pathological states, notably flat-foot and pigeon-toe. Determining causes are direct violence (as in this case) but more commonly indirect, usually when the foot is in hyper-extension (plantar flexion) at the time of trauma.

The subjective symptoms are pain and loss of function, the objective signs, much swelling, alteration in bony landmarks, and shortening between tibial malleolus and hallux. In the dorsal type the scaphoid (if partial) and, in addition, the cuboid (if total) are shoved up to project onto the dorsum to an extent varying with the completeness of the luxation, whilst in the sole the anterior extremity of the os calcis as well as the head of the astragalus form prominences. In the plantar type which is more frequent, this state is reversed, the cuboid and scaphoid projecting into the sole, obliterating the arch and giving rise to a prominence in the centre, which is readily seen in a plantar



# TRANSACTIONS

## OF THE

### NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, held at the New York Academy of Medicine,  
February 12, 1913*

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The President, DR CHARLES L GIBSON, in the Chair

#### BILATERAL TEMPOROMAXILLARY ANKYLOSIS

DR HOWARD LILIENTHAL presented a boy, eight years old, who was admitted to the Mt Sinai Hospital on January 11, 1913. Two years ago he had scarlet fever, and about fourteen months before admission he began to have difficulty in opening his mouth. This had progressed, and when he was admitted to the hospital he could separate the jaws only about one-third of an inch, when there was a sharp, mechanical bar to further action. His face was normally developed, lacking the bird-like deformity which occurred from arrest of development of the jaw when the locking had lasted for years. There was slight asymmetry of the mouth, suggestive of facial nerve disturbance. An X-ray of both sides of the face proved extremely difficult to interpret, although it appeared that the condyle on the left side, at least, was present. On the right side nothing could be made out excepting a mass of new bone which obliterated the landmarks.

On January 13, under anæsthesia, Dr Lilienthal attempted to forcibly dilate the jaws with a wedge, but this proved impossible and after the attempt the jaws were completely locked. Four days later the boy was again etherized, and an operation was performed according to the method which the speaker had published in the ANNALS OF SURGERY for August, 1911. An incision was made along the zygoma down to the bone, and a second incision, at right angles to the first, was made through the skin only. After dissecting up the skin flap, the zygoma was

**hilum** The ring of kidney substance surrounding the hilum varies from one-half to three-quarters of an inch in width. Mesially it joins with the isthmus over the vena cava inferior, the isthmus being two inches in diameter at this point.

*Measurements*—This portion is placed obliquely, pointing downward and inward, and in this, its greatest transverse diameter, it measures three and one-half inches. The greatest vertical diameter is along the outer edge where it measures three and one-half inches but in passing towards the mid-line it contracts to two and one-half inches, its minimum vertical diameter. The thickness varies from an inch at the outer and upper border to a very narrow edge at the lower inner aspect. The hilum measures two and one-half by one and one-half inches, is regular in outline, and is formed at the expense of the central portion of the renal tissue, a thin plate of which, however, persists posteriorly.

*Relations*—The upper pole is on a level with the lower border of the first lumbar vertebra, while the lower border is on a line with the lower border of the third.

*Left Half*—This is more circular in outline than the right and is approximately three and one-half inches in all diameters. Areas of variation in thickness are seen similar to those in the right portion. The hilum is of the same depth as on the right and measures two and one-quarter inches in all directions.

*Relations*—This portion is higher than the right, its upper and lower borders being opposite the upper borders of the first and third lumbar vertebræ respectively.

*The Isthmus*—This is approximately quadrilateral and expands slightly at either extremity to fuse with the annular rims surrounding the hila. The upper and lower edges are sharp and thicken gradually as they fuse with the lateral masses. It arches over the great vessels, describing an angle the apex of which is over the aorta. Tracing the isthmus from left to right we find it passing downward and forward to the anterior surface of the aorta and from this point the right half passes horizontally and backward, an arrangement explained by the higher position of the left kidney.

*Measurements*—Transverse, two inches, vertical, one inch, thickness, one-eighth inch.

*Relations*—The isthmus crosses the mid-line over the intervertebral disc between the third and fourth lumbar vertebræ, joining the right kidney at the right margin of the inferior cava and the left kidney at a point one-half inch distant from the mid-line. The highest point on the right half is one-quarter inch lower than the highest point on the left half.

*The Ureters*—The pelvis of each ureter is dilated to three times the normal size. This, together with a dilated bladder, which presents in the right lateral wall a diverticulum the size of a hen's egg, is explained by the enlarged prostate gland present, and has together with the remaining parts of the urogenital system, no relationship with the embryological defects of the kidneys and upper ureters. From the common iliac arteries, the ureters pass upward, on both sides crossing from within

bility of attempting the posterior method, and yet permit the anterior operation to be done safely and quickly. The case herewith reported is illustrative of such a possibility:

CASE A70173—J. Mc, male, aged sixty-two years. Examination July 5, 1912. No family history of importance and no previous definite illness. Personal history extending over some 20 years of gastric distress which suggested a lesion of the duodenum. The symptoms were somewhat irregular, the chief complaint being a dull epigastric pain coming on about an hour after meals and continuing until the next meal, when the food relieved the pain. There had been no vomiting, no evidence of bleeding, no jaundice and no evidence of acute trouble, no definite history of hyperacidity or hypersecretion. The physical findings were not indicative and the analysis of the stomach contents showed a total acidity of 77, free Hcl. 70, and combined Hcl 8. The long-standing trouble, and a loss of weight during the past few months warranted an exploration and the patient was referred to the hospital.

*Operation* (July 12, 1912)—A right rectus incision was made to expose the pyloric end of the stomach and duodenum. A large thick calloused ulcer was found involving the pylorus and extending  $2\frac{1}{2}$  or 3 inches down the duodenum. The ulcer involved the greatest part of the anterior surface of the duodenum and the peritoneum showed evidence of recent inflammation. The stomach was negative from the anterior view, the gall-bladder was negative, the appendix showed well-marked evidences of disease and was removed.

The lesion and its situation were typical of the group in which such satisfactory results are obtained by a posterior gastro-enterostomy and this operation was decided on. On lifting the transverse colon extensive and apparently long-standing adhesions were found binding the mesocolon and mesentery of the jejunum for several inches along the first part of the jejunum. An examination of the upper jejunum showed the presence of four well-marked diverticula, all showing the same formation. Three of these diverticula were about 16 inches from the origin of the jejunum and within 1 inch of each other, while the fourth was about 4 inches from the duodenojejunal juncture. They varied in size from a hazel nut to an English walnut. All wer

to him that choice lay between the three subscapulars. Of these the uppermost is the shortest, and, passing down behind the axillary artery, soon sinks into the subscapularis, which it supplies. Its origin from the fifth and sixth cervical nerves is almost identical with that of the long thoracic, which arises additionally from the seventh. Its size is equal to that of the long thoracic and its proximity is close, it being but one-half inch behind and to the outer side (Fig 7). It usually consists of two branches, an upper and a lower. Thus it is possible for one branch of the upper subscapular to be preserved to dominate the upper portion of the subscapularis, the lower portion receiving its innervation from the lower subscapular which supplies, in addition, the teres major. The middle or long subscapular continues its lengthy course to the latissimus dorsi. The short subscapular nerve, therefore, is the least important of the three, supplies only part of the subscapularis, and fulfils the conditions

A horseshoe-shaped flap is outlined over the hollow of the axilla with its base corresponding to the anterior fold (lower border of the pectoralis major). The flap, including the underlying axillary fascia, is raised and reflected over the anterior wall. The long thoracic nerve is sought for coursing down the middle of the inner wall of the axilla, beneath the fascia covering the serratus magnus. It is traced up to the apex of the axilla, beneath the great neurovascular bundle, which is retracted forward against the anterior axillary wall. The posterior cord of the brachial plexus will thus be stumbled upon, it being the lowest constituent of our upturned neurovascular bundle. The three subscapular nerves are readily seen coursing beneath the fascia upon the subscapularis and are traced up to the posterior cord. The uppermost of the three is now found but one-half inch from the long thoracic. It is approximated to the long thoracic, both are severed, and the proximal portion of the short subscapular united in contact end-to-end, with the distal portion of the long thoracic, using very fine catgut suture. The line of union is wrapped about with egg-membrane in order to prevent interference by connective-tissue from without, and to facilitate regeneration of the neurilemma tube.

FIG 2



Showing the way in which the  
obliteration of the defect

After second injury

FIG 5



22



Eight months later

FIG 6



Showing the various oblique

fractures

from a car and again injured his wrist, which was moderately swollen and slightly painful for a few days. Since the receipt of this injury, when he completely supinated the hand or pushed anything with it, he felt something slip out of place in the region of the head of the ulna. Excepting for his inability to use the pliers and a slight decrease in power, this interfered but little with his work.

On examination, the right wrist was a little wider than the left, and showed a slight silver fork deformity, but without radial shifting of the carpus. On supination, the dorsal prominence of the ulnar head disappeared, leaving a depression. In this position, the dorsal portion of the sigmoid cavity of the radius could be felt. On pronation, the ulnar head could be felt to slip back into place, but it could readily be pushed backward and forward. It could not be separated laterally from the radius. An X-ray, taken two days ago, eleven months after the original injury, showed the ulnar styloid to be still ununited, and a persistence of the backward curve of the radius due to the imperfect reduction of the dorsally displaced lower fragment. An interesting feature of the case was the beautiful way in which nature had rounded off the projecting lips. In this case there was apparently a forward dislocation of the head of the ulna associated with the second fracture, if not also with the first. This had evidently healed, but the strain on the front of the capsule and the triangular ligament due to the dorsally displaced lower radial fragment was such that the third injury tore the ulnar head loose from its attachments (Fig 1).

Dislocations at the lower radio-ulnar articulation, Dr Darrach said, might be uncomplicated or associated with fracture of the lower radius. The ulnar head may pass dorsad or ventrad, and in the latter case may be pulled outward, so as to lie ventral to the radius. Of the ventral dislocations, unassociated with fracture of the radius, Cotton<sup>1</sup> has collected 27 cases from the literature, to which he has added one. This list could be further increased by the case shown by Hitzrot<sup>2</sup> in January, 1912, by the case shown by Darrach<sup>3</sup> in May, 1912, and by three others reported

<sup>1</sup> Cotton ANN OF SURG, March, 1912, I, p 368

<sup>2</sup> Hitzrot ANN OF SURG, April, 1912, IV, p 623

<sup>3</sup> Darrach ANN OF SURG, November, 1912, I, p 802

TUBERCULOUS PERITONITIS SIMULATING RECURRENT  
ATTACKS OF APPENDICITIS

DR. W. S. SCHLEY presented a young man of nineteen who was admitted to the hospital on December 27, 1911. His chief complaint was pain in the right lower quadrant of the abdomen. His family history was good, both parents being alive and well. Two years ago he had suffered from cough and expectoration, and was told that he had trouble with the left apex. He gave up his work, lived out of doors, and had apparently recovered. About eight months ago he began to suffer with stomach disturbances, eructations of gas and gurgling, but he did not lose weight. Three months before coming to the hospital, and while at work, he was seized with a severe epigastric pain, he managed to complete his day's work, however, and by night the pain had passed off. There was no nausea with this attack. Six weeks later he had a similar seizure, the pain lasting about eight hours and extending from the epigastrium to the right lower quadrant. He felt uneasy and tired before the onset of the pain. Two weeks before admission he had a third similar attack, the pain being most severe in the right lower quadrant. It persisted about twelve hours, and was accompanied by nausea and vomiting. Constipation had preceded this attack.

The patient was seen by a physician at this time, and the case was regarded as one of appendicitis. Since his first attack there had been some soreness in the right lower quadrant, with occasional twinges of pain. His general appearance, on admission, was that of a well-nourished, muscular, healthy young man. In the chest, an occasional fine râle could be heard at the right apex posteriorly. Expansion was good and equal on the two sides. The heart sounds were clear and strong, the rate 56 per minute. In the abdomen there was a small area of tenderness to the right and below the umbilicus, without rigidity. There were no masses to be felt. The superficial glands of the body were not enlarged. The temperature, on admission, was  $97\frac{3}{8}$  and beyond a slight rise to  $100\frac{4}{8}$  following the operation, the temperature remained practically normal.

At operation, through the usual intermuscular appendic incision, there were found scattered over the peritoneal surfaces numerous discrete, pearly nodules, varying in size from a pin-point to a pin-head. These were very numerous in the mesentery



side. Vaginal examination located the uterus in the hollow of the sacrum, and there was a mass in the right side, this was connected with the uterus and both were fairly well fixed. The case was regarded as one of chronic salpingitis.

Operation showed that throughout the abdomen and as far as the exploration could be carried there were dry adhesions of the intestines to the abdominal wall and to each other, a peritoneal obliteration. There were a number of vascular bands of small size, and scattered here and there on the surface of the intestines were small, seed-like yellowish nodules. It was only with the greatest difficulty that he was able to reach down to the right tube, which was much thickened and adherent, and showed larger tubercles on its surface. The tube was excised, and the abdomen was closed, as the left tube, while adherent, was not apparently invaded.

This patient had done extremely well, and had gained in weight since leaving the hospital. She still complained of some pain in the right side, but it was much less severe than formerly. She was still constipated. Her condition of nutrition and general health, in spite of the profound peritoneal matting, seemed remarkable.

The second case was that of an Italian woman, a housewife, twenty-five years old, whose chief complaint was pain in the right lower quadrant of the abdomen. This began three months ago, it had been gradually getting worse, and was most severe on exertion and during the menstrual epochs. The latter function, however, had been normal as to time and flow. The patient had been married for eight years, she had miscarried during the second year of her marriage and had not been pregnant since.

Her appearance on admission to the hospital was and still remained up to the present time that of a well-nourished woman with a good color of the skin and mucous membranes. She did not look ill. Nothing abnormal was found in the chest. The abdomen was soft, without masses, with moderate tenderness over the lower part on both sides. The uterus was retroverted and fairly firmly fixed in the hollow of the sacrum. There was tenderness in both lateral fornices, with some induration. A diagnosis of chronic salpingitis was made. Examination under ether showed a hard, small uterus, retro-

forms in women were usually accompanied by disturbance in the pelvic organs, which caused them to seek relief. About 50 per cent. of the ascitic cases were said to go two years without a recurrence of the trouble, while only 30 per cent or 40 per cent. reached the three year limit. Symptomatic and practical recovery from even the most advanced condition of tuberculous peritonitis was far from unknown

DR. HENRY H. M. LYLE said that cases of tuberculous peritonitis belong to a class of tuberculous cases in which heliotherapy did the most good. After operation it was essential to treat these patients by exposure to the sun in order to assure a permanent cure of the tuberculosis, and in all later cases that he had operated on, he had used this method

DR. WILLIAM C. LUSK said that in a case of extensive tubercular peritonitis, with tubercular involvement of the endometrium, tubes and ovaries, after removal of the adnexa, with fresh air treatment, great gain in health ensued, but the uterine hemorrhages and a tubercular infection of the abdominal wound persisted. These latter conditions became cured following the administration of tuberculin, in conjunction with the use of which the opsonic index, which had previously been low, rose to a high degree. The patient is now living and without recurrence, seven years post-operative.

#### PRIMARY SPLENOMEGALY OF THE GAUCHER TYPE SPLENECTOMY.

DR. WILLIAM A. DOWNES presented a woman, twenty-eight years old, who was born in eastern Tennessee and who had spent most of her life in the South.

The patient stated that she had never been strong, like other children, and was always easily fatigued. When she was thirteen years old she was so weak that she consulted several physicians, and at that time a mass was observed in the left hypochondrium. The physicians she saw were not positive whether this was the spleen or kidney. She was quite pale and was given iron and arsenic, and external applications were applied over the tumor. She improved temporarily, and then again began to suffer from general weakness. The mass in her abdomen gradually increased in size. She consulted other physicians, who told her that the mass was her spleen. For years she had suffered from a

Operation, December 14, 1912: The spleen was removed through an eight-inch incision through the middle of the rectus. It was free from adhesions, excepting posteriorly, and these were easily broken by the hand after the pedicle had been secured. There were four or five anomalous vessels of large size, which were secured separately. A small cigarette drain was introduced at the centre of the wound, as there was some oozing from a small tear in the mesentery.

The operation produced very slight shock and the patient made an uneventful recovery excepting that on the day after the operation she had a hemorrhage in the right conjunctiva, and an ecchymotic area about the size of an adult palm over the right buttock. She was given 20 c.c. of horse serum hypodermatically, and there were no further evidences of a tendency to bleed. The drain was removed on the seventh day. The temperature ranged between 100 and 101 for twenty-one days, then gradually falling to normal. The wound healed without any trouble. Four days after the operation a blood count showed 3,860,000 red cells, 16,000 leucocytes, 97 per cent polynuclears and 76 per cent of hæmoglobin. When the patient left the hospital, on January 24, 1913, 41 days after the operation, the blood count was 4,800,000 red cells, 8800 white cells; 45 per cent of polynuclears, 16 per cent of large lymphocytes, 26 per cent of small lymphocytes, 8 per cent of transitional cells and 3 per cent of eosinophiles. At this time the patient weighed 116 pounds, and her general condition was rapidly improving. The shortness of breath had disappeared, and barring some pain in the back shortly after the operation, she had suffered no discomfort, nor had she had pain in the long bones.

The pathological report in this case, made by Dr. Taiter, was as follows. The weight of the spleen, together with the extravasated blood, was 1813 grams, and it measured  $35 \times 13.5 \times 6.5$  cm. It was oblong in shape and fairly uniform in thickness. The surface of the organ showed a uniformly smooth and transparent capsule, save for scattered, very fine dew-like points of less than 1 mm diameter. Its color was uniformly reddish-brown, with a grayish tinge. The organ felt rather firmer and more leathery than normal,—of about the consistence of soft liver. On section, it cut readily. Its cut surface was flat, firm and leathery, considerably less friable than normal spleen. Its color

perfectly successful, in the fourth the operation was a secondary one, which rendered it more difficult, and that patient was still under treatment.

## UNILATERAL RENAL HÆMATURIA.

DR EUGENE H. POOL presented a man, forty-nine years old, married, who came to the French Hospital on October 28, 1912, complaining of passing very red urine, and of weakness. These symptoms were of about two months' duration. There was no pain. The patient stated that up to two years ago he had suffered from frequent nose-bleeds. He denied venereal infection and his habits were good.

Upon inspection, the patient did not appear very ill, although his skin had a peculiar brownish discoloration, which he said was his natural color. The lungs were negative; the heart gave a systolic murmur at the apex. The kidneys were not palpable, the knee-jerks were exaggerated. Upon cystoscopic examination, the bladder wall, trigone and ureteral openings were apparently normal. Both ureters were catheterized and found patent. A dark red fluid was secreted from the left ureter, an amber-colored fluid from the right. Upon examination, the secretion from the left ureter was found to be loaded with blood-cells and a trace of albumin, no casts. That from the right ureter showed normal urine. The von Pirquet, Wassermann and X-ray tests were all negative. There were no tubercle bacilli in the urine. The indigo-carmin test showed that both kidneys were functioning equally and normally.

The diagnosis of essential hæmaturia was made on account of the normal appearance of the bladder wall, the absence of pus and casts in the urine, the negative X-ray findings, the absence of pain and tumor, the failure to find any etiological factor to account for the blood in the urine. However, the age of the patient and the short duration of the bleeding made it impossible to exclude neoplasm, and for that reason rather than to check the hemorrhage operation was deemed advisable.

Operation, November 12, 1912. The left kidney, upon exposure, appeared approximately normal in size and contour. Its surface was studded with a number of dark, bluish areas of various sizes, with the normal color of the kidney showing between them. To decrease the danger of hemorrhage and avoid

"essential hæmaturia" is misleading. However, while uncertainty on this point prevails, the term "essential hæmaturia" should be restricted to those cases in which no lesion, either gross or microscopic, can be found. In the case Dr. Pool had shown, which before operation was regarded as one of essential hæmaturia, a lesion of the kidney was subsequently demonstrated, namely a chronic interstitial nephritis.

DR LILIENTHAL said he had operated on a similar case about a year ago. The patient was a young man, a medical student, who for several years had suffered from hemorrhage from the kidneys, and upon a cystoscopic examination on three different occasions, blood was found coming from the left kidney. There were no evidences of nephritis. For the same reasons as those given by Dr. Pool, and particularly to exclude the presence of a new growth, especially hypernephroma, a nephrectomy was advised. Upon exposing the left kidney, it appeared to be perfectly healthy, and after its removal it was examined by Dr. F. S. Mandlebaum, who made a minute pathological examination and was unable to demonstrate any lesion. That was a case, apparently, of undoubted essential hæmaturia. The young man had remained perfectly well up to the present time.

#### SUPPURATIVE PYELITIS · NEPHROLITHIASIS. NEPHRO-URETERECTOMY

DR. LILIENTHAL presented a man, thirty-five years old, who came under observation on April 9, 1912, with the history of a number of attacks of urethritis, the first one fifteen years ago. He had lues seven years ago, which was apparently cured, as evidenced by a negative Wassermann. Five years ago he had his first attack of renal colic, followed by several others. His chief complaint was that he suffered from pain in the suprapubic region, which was aggravated on walking. He urinated twice during the night. The urine contained large quantities of pus and a few red blood-cells. He had been treated for some time by a genito-urinary specialist, who had done a cystoscopy but did not catheterize the ureters. The opinion of this specialist was that there was no calculus, and that the patient's symptoms had their origin in the deep urethra and trigone. The mouths of the ureters were said to have had a normal appearance, and to have emitted clear urine.

Upon Dr. Lilienthal's suggestion, a radiogram was made by

polypoid-like growths. The cystoscopic picture was that of a tuberculous cystitis

Both ureters were catheterized, with the following result: right, 30 c c of urine, containing a few leucocytes and 17 grams of urea to the litre. Left, 3 c c of urine, containing a small amount of pus and  $3\frac{1}{2}$  grams of urea to the litre. The indigo-carmine reaction appeared from the right kidney half an hour after injection; from the left, two hours. Practically all the indigo-carmine was excreted by the right kidney.

A nephrectomy was done by Dr. Pool about six weeks ago. The left kidney was found considerably enlarged and distended with pus. The upper end of the ureter did not appear to be much involved, but on account of an experience which he had several years ago, the speaker said he decided to remove it. In the case referred to he had removed a tuberculous kidney, leaving the ureter, which apparently was not involved. Some months later, Dr. Alexander B. Johnson operated on the same patient, removing a very large tuberculous ureter. (ANNALS OF SURGERY, vol liii, 1911, p. 563)

Having this experience in mind, Dr. Pool said, he removed the ureter in the present case, following the method described by Dr. Howard Lilienthal. Through a three-inch incision close to and parallel to Poupart's ligament and mesial to the anterior spine, the ureter was very easily removed extraperitoneally, a vertebrated sound having been first passed into it from above. The ureter was identified by palpating the sound and then easily exposed and freed for a short distance by sight; it was then an easy matter to separate the rest by touch. In treating the stump, he cut it half way across, using the upper end as a handle, cauterizing the lower end with the actual cautery and ligating it before it was completely severed. Most of the ureter was considerably dilated, its walls were thickened, and sections taken from several parts, including the lowermost, showed marked tuberculous involvement.

Both wounds healed readily and the patient was discharged in 23 days. Her weight and health had considerably improved since the operation, and the speaker said he could commend Dr. Lilienthal's procedure as extremely useful and simple in a primary nephrectomy.

DR. LILIENTHAL said he had tried at various times to bring

two cases in males had been recorded, one by Brill, Libman and himself in 1904, and the other, his own recent case

Up to about ten years ago, Dr. Mandlebaum said, the Gaucher type of splenomegaly was not recognized clinically, and the various types of enlarged spleen had been grouped together in the class of splenic anæmias. Shortly after the report of Bovaird's case, Brill published a paper in the *American Journal of the Medical Sciences*, stating that the three cases he had under his observation for many years must be of the Gaucher type, basing his opinion on the findings of Bovaird, whose case was not, however, recognized as belonging to this type until it came to autopsy.

In this disease the enlargement of the spleen usually begins in early infancy, followed later by enlargement of the liver. There are no palpable lymph nodes, and the blood picture shows nothing characteristic. The prominent symptoms are often caused solely by pressure from the enlarged spleen. The patients have a unique brownish pigmentation of the skin, especially on those parts exposed to the light, and there are peculiar changes in the conjunctivæ. Dr. Mandlebaum said he had had the opportunity of making an autopsy on two of Brill's cases, and both proved to be of the Gaucher type. The speaker said that in his own case, the diagnosis had been made by Dr. Mark S. Reuben, of this city. In the case reported by De Jong and Van Heukelom, the diagnosis was also established clinically.

The course of the disease is very chronic, the patients usually dying from some intercurrent affection. A splenectomy could not be expected to cure these cases, as in Banti's disease, because the bone marrow and the lymph nodes were involved as well. The speaker suggested that these cases be kept under observation, so that an autopsy might eventually be obtained with the object of learning what changes might occur in the bone marrow and lymph nodes after splenectomy.

In reply to a question, Dr. Mandlebaum said the weight of the spleen varied greatly. In his own recent case, a child, it weighed 490 grams, while in the second case reported by Brill, Libman and himself, it weighed 7400 grams (over 14 lbs.), being the largest recorded in this disease.

DR. WALTON MARTIN showed a spleen which he removed about a month ago. The case was regarded as one of splenomegaly, and the operation was done under that assumption, but

the remainder was readily approximated without the slightest tension.

The first dressing was on November 16, merely with the object of removing the axillary drainage tube. At this time there was already noticed a very suspicious cyanosis of the skin flaps, as of an impending necrosis. After this the patient complained of considerable pain and discomfort in the region of the wound. She had an evening rise of temperature to 102.5, but there was never more of a purulent discharge than could be accounted for by the rather extensive sloughing of the skin flaps, which had actually occurred. At no time was there any actual sloughing of the deeper tissues. The upper part of the incision healed by primary union.

On November 24, the eleventh post-operative day, the dressings were found to be saturated with blood, and examination showed that the wound was covered with a soft blood clot, about five inches in diameter and half an inch thick. When this was gently lifted off, there were exposed two bleeding areas, each about half an inch in diameter, one situated just below the clavicle, the other near the inferior angle of the incision. A purse-string suture encircling these points controlled the bleeding completely for the time being. The general condition of the patient was poor. The pulse was rapid and weak, but regular, and there were no signs of marked loss of blood.

On the following day a similar hemorrhage occurred from a point situated about the centre of the granulating area. The next day there was no bleeding, but as a prophylactic measure, 15 cc of human serum were injected subcutaneously. On November 27, the fourteenth post-operative day, there was again very active bleeding, approximately from the same areas which had been sutured three days before. This time the bleeding was checked by firm tamponade with gauze, dipped into a mixture of adrenalin and diphtheria antitoxin. The patient's hæmoglobin content dropped to 40 per cent, and the coagulation time was found to be ten minutes. The general condition of the patient was now very poor; she refused all nourishment, was very weak, and the outlook seemed well-nigh hopeless. There were, however, no further hemorrhages until December 1, the eighteenth post-operative day. Again there was a cessation of all bleeding until December 4, when on exposing the wound there was found



pyriform fossa and the false cord of the right side, a very large opening was necessarily made in the pharynx in order to get wide of the disease. The epiglottis was included with the larynx. The large opening in the pharynx was closed with fine chromic gut with much difficulty. Wide gauze packing saturated with a one per cent. iodine solution was placed well down in the lower angles of the wound on either side of the trachea with the object of setting up inflammatory adhesions and thereby preventing infection from spreading in this direction. A small drain was inserted into the upper end of the wound, and the skin partially closed. A No 24 French catheter was introduced through the left nostril well into the œsophagus for feeding purposes. By the use of the suction apparatus with a small mouth tip, the pharynx was kept free from saliva almost from the start, the patient soon learning to use this means of clearing his throat. Dr. Downes said he felt confident that the use of this apparatus aided greatly in obtaining primary union in the large pharyngeal wound. The gauze pack was removed from the lower part of the wound on the fourth day, and the walling off was apparently complete, as there was no tendency for secretions to burrow into the mediastinum. The feeding tube was kept in the nose for two weeks after this all feeding was by the mouth, the food for a few days consisting of liquids only, soon followed by semi-solids. At no time was there any leakage from the pharyngeal wound.

The patient's temperature was  $101^{\circ}$  the day after the operation, and never above  $100^{\circ}$  after the fifth day. The speaker said he attributed this uneventful convalescence to the fact that infection did not spread to the mediastinum, showing the value of the gauze pack. He also believed that he was assisted in obtaining complete primary union in so large a pharyngeal wound by the use of the sucker, which kept the pharynx free from saliva and mucus. At the present time the wound had healed, with the exception of a very small granulating area at the upper angle.

young baby. Nine months ago she first noticed a growth in the left cheek, which had been slowly increasing in size. This had never been painful

On examination, there was a large, hard swelling over the left superior maxilla and involving the bone itself. There was bulging of the outer wall of the left nostril, and through the mouth the superior maxillary bone was found to be enlarged in the region of the first and second molars, this enlargement extended into the nose and was plainly seen by the X-ray as a dense shadow of apparently thickened bone, extending to the orbit. An examination of the blood gave 12,000 leucocytes, with 68 per cent of polymorphonuclears. The urine was negative. The temperature ranged between 99 and 100; pulse, 84; respirations, 20

On December 9, 1912, under ether intratracheal anæsthesia, the left common carotid was exposed by an incision in the neck, parallel with and in front of the left sternomastoid muscle. Dr. Lilienthal said it was his intention to extirpate the left external carotid artery, but the division of the vessel must have been very high and could not easily be found, so after about fifteen minutes a temporary ligature was placed about the common carotid and the wound was left open. The right external carotid artery was then extirpated without difficulty, the bifurcation being found in its normal situation. This wound was now closed by suture, with temporary tube drainage. Attention was now directed to the attack upon the tumor itself, and during this part of the operation the left common carotid was drawn upon by a ligature in the hands of an assistant to produce temporary hæmostasis. An incision was made along the superior maxilla above the line of the alveolar process, and upon removing the mucous membrane by blunt dissection it was found that the tumor involved the bone, which was softened and gave the characteristic crackling sound. The growth evidently extended from within the nose to the orbital margin, and as far back as the first molar, while below its limits were marked by the second bicuspid. In order to gain a better access to the growth, Dr. Lilienthal said he adopted a method suggested by Dr. T. Passmore Berens: namely, he incised the upper lip vertically at its central point and continued the incision through the lip to the ala of the nose and along the floor of the nasal cavity. With

comata, the better, as it was not a malignant tumor at all. That point was brought out in a discussion on the subject before this society about eight years ago. A case had been presented in which he had made the diagnosis of giant-celled sarcoma of the femur, and on account of the subsequent course of the case, the correctness of that diagnosis was questioned, and at that time he made the statement that a giant-celled sarcoma was not a malignant tumor at all. Since then, several pathologists have made similar statements.

In the second case mentioned by Dr. Lilienthal, the tumor was a giant-celled sarcoma, and the speaker said he was not surprised to learn that the patient was still alive, in spite of the fact that a complete extirpation had been found impossible.

In the case shown by Dr. Lilienthal to-night, the speaker said that to the best of his recollection, the pathological picture was that of a spindle-celled osteo-sarcoma, which was usually of a rather malignant type and offered an unfavorable prognosis.

DR. ARPAD G. GERSTER said the preliminary ligation of arteries in operations on the superior maxilla seemed to have become a fixed procedure under the belief that it added to the safety of the operation. Two or three weeks ago, Dr. Gerster said, he ligated the external carotid before the removal of a tumor in the posterior pharynx which was attached to one of the wings of the pterygoid. Previous to that, he had never resorted to a preliminary ligation of the vessels in the neck in operations of this kind, and in this single instance, forty-eight hours after the operation, the patient had a cerebral embolism and died.

Personally, Dr. Gerster said, he failed to see the benefit of such a preliminary ligation. After the surgeon had made his preparatory incision and divided the bony attachments, and removed the detached jaw, the wound could be plugged and the hemorrhage well controlled, and the internal maxillary artery could be caught and tied. After the extirpation of the growth was completed, we had a visible cavity from which the bleeding could be well controlled. He did not think that a preliminary ligation of the external carotid was necessary, and that it simply added to the dangers of an already serious operation.

DR. WALTON MARTIN said that two weeks ago he saw a case of carcinoma of the upper jaw which necessitated an extensive

both superior maxillæ, where the only incision made was a vertical one through the upper lip, and the bleeding was not as easily controlled as in the more open operation of resection of the superior maxilla.

DR CHAS L. GIBSON said that some years ago, preliminary to attacking a tumor in the nasopharynx, he extirpated the external carotid on one side and tied it on the other. In spite of these precautions, he had a very alarming hemorrhage during the course of the operation.

DR LILIENTHAL, in closing, said the operative procedure which he had followed in this case, which he believed to be a good one and which he had successfully carried out in other cases, was to extirpate both external carotids, as suggested by Dawbarn. The artery on the right side was extirpated without any trouble, but the left external carotid was situated so high up that it could not be reached. He thereupon ligated the left common carotid, which he had done in former cases without injurious results. In one case, a patient with a pulsating exophthalmus, supposed to be due to an aneurism of the cavernous sinus, he had ligated both common carotids within ten days of each other: that patient survived for several years, and finally died from hemorrhage after another operation upon the neck for the ligation of anastomatic arteries.

#### ON THE FORMATION OF BONE IN THE HUMAN PENIS

DR ARPAD G. GERSTER read a paper with the above title, for which see page 896

DR MANDLEBAUM said the formation of bone in fibrous connective tissue was not purely a pathological process, but occurred physiologically as well, on the roof and sides of the skull. Most of the bones of the face were also formed in this manner. When bone formation took place in fibrous connective tissue, the first step in the process was the change or transformation of the normal connective-tissue cells into osteoblasts, this was a process of metaplasia, in which the connective-tissue cells lost their identity and were practically transformed into new cells. The intracellular substance became transformed into osteoid tissue. The final stage was the deposit of lime salts, and we then had true bone.

This new bone formation in various tissues of the body was

## BOOK REVIEWS.

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SURGICAL OPERATIONS, A Hand-Book for Students and Practitioners By PROF FRIEDRICH PELS-LEUSDEN, of Berlin  
Authorized English translation by FANTON E GARDNER, M.D., of New York Rebman Company, 1912

PROFESSOR PELS-LEUSDEN is well known as chief surgeon in the University Surgical Clinic at the Royal Charity Hospital in Berlin, where his teaching experience should well qualify him to prepare a book on surgical operations which might be of service to students and general practitioners. This book is virtually a text-book on operative surgery, as it embraces all of the ordinary operations, and might just as well have been addressed to practitioners of surgery. It is a well rounded book, and one to which the surgeon may turn expecting to find a description of any of the usual operations.

The author departs often from the conventional in the description of his own peculiar methods. This is to be expected in a surgeon of personality. It is to be regretted that more of the text-books for practical use do not oftener reflect the peculiarities of the author. Most of our surgical books are written apparently with pains to conform to what is most generally accepted.

This book contains some six hundred and sixty-eight illustrations—most of them poor, from the artistic standpoint. Although inartistic, it may be said of them that they show what the author wishes to show. There has been such a surfeit of beautiful pictures in the last twenty years that it seems rather novel again to encounter the class of illustrations which characterized the preaseptic period. The diagrammatic method is much employed in this book—and very effectively. The illustrations are simply numbered, and lack the descriptive legends which have proved so useful in modern books. It is not at all satisfactory to have to search the text for a description of an illus-

while historic features are properly touched upon. A chapter is devoted to the experimental surgery of the heart.

The subject in general is presented in a thorough and logical manner. The book is well arranged and profusely illustrated so that the interpretation of the text is made easy. Practically all methods of technic having to do with vascular surgery are exhaustively described; the relative merits of the various procedures are thoroughly discussed and very fair and sane conclusions are drawn. The work evidences a painstaking study of contributions on the subject. Moreover, the author has evidently devoted much thought and labor to the development of technical details. This is evidenced, in part, by innumerable ingenious devices of his own. The work, therefore, while a fairly thorough compilation of contributions, is far more than a review, since it represents the ideas of a man who has tested and practised the various procedures.

The work is dedicated to Carrel, and to his efforts Jeger rightly attributes the recent developments in vascular surgery.

The book begins with a review of the general principles of vascular, including endothoracic, surgery. Jeger emphasizes the fact that this branch of surgery demands not only unusual dexterity but also the extreme of asepsis, for which all outward conditions must be perfect. This phase, as applied to laboratory work, is fully elaborated.

The technic of vascular surgery is exhaustively described. The significance of blood-vessel surgery in experimental medicine is gone into extensively, and it is made apparent that a fertile field has been opened for the study of the physiological and surgical problems. The whole question of transplantation is considered and the various phases of auto-, homo- and hetero-transplantations discussed.

The work unquestionably will prove of much value to research workers by reason of the technical instruction and suggestive ideas which it offers and for its bibliography. For the general surgeon it will prove an interesting and instructive résumé of vascular surgery, it also presents much valuable gen-

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